



SILICON  
VALLEY

---

LIVE

1  
00:00:05,030 --> 00:00:02,550  
out of nasa's ames research center where

2  
00:00:07,430 --> 00:00:05,040  
we talk about all the nerdy nasa news

3  
00:00:09,430 --> 00:00:07,440  
you need to know about so today i have

4  
00:00:12,230 --> 00:00:09,440  
with me my friend and office mate

5  
00:00:14,310 --> 00:00:12,240  
tiffany hey hi everyone i am your

6  
00:00:17,269 --> 00:00:14,320  
co-host tiffany blake if you didn't know

7  
00:00:19,189 --> 00:00:17,279  
we are live on twitch youtube facebook

8  
00:00:20,630 --> 00:00:19,199  
and periscope uh but if you want to

9  
00:00:22,310 --> 00:00:20,640  
participate in the chat and ask our

10  
00:00:24,390 --> 00:00:22,320  
guests some questions there's only one

11  
00:00:27,990 --> 00:00:24,400  
place you can do that and that is at

12  
00:00:34,389 --> 00:00:31,189  
nasa right and we are excited today to

13  
00:00:37,110 --> 00:00:34,399

be holding our second annual nasa themed

14

00:00:40,150 --> 00:00:37,120

halloween costume and cosplay contest

15

00:00:41,990 --> 00:00:40,160

yes i'm excited i'm excited uh if you're

16

00:00:44,549 --> 00:00:42,000

a nasa fan looking for a last minute

17

00:00:45,990 --> 00:00:44,559

halloween outfit you're in luck

18

00:00:48,549 --> 00:00:46,000

we are going to show you a collection of

19

00:00:50,549 --> 00:00:48,559

nasa inspired costumes and tell you how

20

00:00:53,430 --> 00:00:50,559

you can recreate them at home right and

21

00:00:55,270 --> 00:00:53,440

if you do end up using any of our space

22

00:00:57,430 --> 00:00:55,280

themed costumes for halloween or some

23

00:00:59,430 --> 00:00:57,440

other nasa inspired costume we want to

24

00:01:02,470 --> 00:00:59,440

see it so you can share those with us on

25

00:01:03,750 --> 00:01:02,480

social media using the hashtag nasa

26

00:01:06,390 --> 00:01:03,760

costume

27

00:01:08,230 --> 00:01:06,400

yeah so before we start abby how about

28

00:01:11,270 --> 00:01:08,240

we remind the people about our cool

29

00:01:13,190 --> 00:01:11,280

clock oh okay yes so this is our moon

30

00:01:15,590 --> 00:01:13,200

countdown clock that you see right here

31

00:01:18,630 --> 00:01:15,600

and that is because five years from now

32

00:01:20,550 --> 00:01:18,640

in 2024 we are planning to send humans

33

00:01:21,510 --> 00:01:20,560

to the moon as part of our artemis

34

00:01:22,950 --> 00:01:21,520

program

35

00:01:25,429 --> 00:01:22,960

so this clock right here is counting

36

00:01:26,390 --> 00:01:25,439

down the days hours minutes and seconds

37

00:01:29,109 --> 00:01:26,400

until

38

00:01:31,670 --> 00:01:29,119

the next man and the first woman will

39

00:01:33,429 --> 00:01:31,680

set foot on the south pole of the moon

40

00:01:34,870 --> 00:01:33,439

so to learn more about that you can go

41

00:01:36,230 --> 00:01:34,880

to [nasa.gov](http://nasa.gov)

42

00:01:37,109 --> 00:01:36,240

artemis

43

00:01:38,710 --> 00:01:37,119

so

44

00:01:40,069 --> 00:01:38,720

should we get right into it yeah should

45

00:01:43,109 --> 00:01:40,079

we see some cards

46

00:01:45,910 --> 00:01:43,119

yes okay so our first category is

47

00:01:47,270 --> 00:01:45,920

everyday nasa looks so the the outfits

48

00:01:49,350 --> 00:01:47,280

you're going to see are things that our

49

00:01:50,950 --> 00:01:49,360

researchers and engineers wear

50

00:01:52,389 --> 00:01:50,960

day-to-day doing their work doing

51  
00:01:54,469 --> 00:01:52,399  
special tests you'll see them around the

52  
00:01:57,429 --> 00:01:54,479  
center wearing these things

53  
00:02:03,109 --> 00:01:57,439  
so let's bring out our first guest

54  
00:02:08,150 --> 00:02:05,670  
hey now

55  
00:02:11,029 --> 00:02:08,160  
oh yeah

56  
00:02:13,430 --> 00:02:11,039  
come on up here

57  
00:02:15,910 --> 00:02:13,440  
excellent we'll give you a minute to

58  
00:02:17,990 --> 00:02:15,920  
get your tools set there

59  
00:02:19,990 --> 00:02:18,000  
get all tucked in

60  
00:02:23,350 --> 00:02:20,000  
and you might have to take off your gas

61  
00:02:25,670 --> 00:02:23,360  
mask there yeah

62  
00:02:27,270 --> 00:02:25,680  
welcome so why don't you start by

63  
00:02:29,190 --> 00:02:27,280

introducing yourself to the audience and

64

00:02:32,070 --> 00:02:29,200

tell us what you do good so my name is

65

00:02:33,990 --> 00:02:32,080

um dr mary beth wilhelm and i'm a

66

00:02:35,830 --> 00:02:34,000

research scientist here at nasa and i'm

67

00:02:36,470 --> 00:02:35,840

an astrobiologist which means i study

68

00:02:42,869 --> 00:02:36,480

the

69

00:02:44,790 --> 00:02:42,879

solar system

70

00:02:47,990 --> 00:02:44,800

so tell us about what you're wearing all

71

00:02:53,190 --> 00:02:49,750

is what i wear when i'm collecting

72

00:02:54,470 --> 00:02:53,200

samples in a mars analog environment on

73

00:02:56,710 --> 00:02:54,480

earth so

74

00:02:59,190 --> 00:02:56,720

because mars is so far away and it's so

75

00:03:01,350 --> 00:02:59,200

expensive to get there we often go to

76  
00:03:03,509 --> 00:03:01,360  
places on earth that are like mars so we

77  
00:03:04,630 --> 00:03:03,519  
can study certain things about it

78  
00:03:07,589 --> 00:03:04,640  
and

79  
00:03:09,670 --> 00:03:07,599  
them what kind of environments on earth

80  
00:03:11,110 --> 00:03:09,680  
are actually like mars like what are you

81  
00:03:13,509 --> 00:03:11,120  
looking for there

82  
00:03:14,869 --> 00:03:13,519  
right so um

83  
00:03:16,710 --> 00:03:14,879  
right now i'm studying this place called

84  
00:03:18,390 --> 00:03:16,720  
the atacama desert in chile

85  
00:03:20,309 --> 00:03:18,400  
and it's one of the driest places in the

86  
00:03:21,270 --> 00:03:20,319  
world it only rains in the region that i

87  
00:03:24,149 --> 00:03:21,280  
visit

88  
00:03:25,830 --> 00:03:24,159

once per decade that's absurd wow it's

89

00:03:27,430 --> 00:03:25,840

crazy dry like i can count the number of

90

00:03:29,110 --> 00:03:27,440

plants that i saw on one hand during our

91

00:03:31,430 --> 00:03:29,120

field trip that's so strange and because

92

00:03:33,270 --> 00:03:31,440

of that it has some of the lowest levels

93

00:03:35,350 --> 00:03:33,280

of biomass on the entire planet so

94

00:03:36,229 --> 00:03:35,360

there's very very few living organisms

95

00:03:37,350 --> 00:03:36,239

there

96

00:03:39,990 --> 00:03:37,360

and

97

00:03:41,270 --> 00:03:40,000

us humans are very dirty yeah

98

00:03:43,190 --> 00:03:41,280

and that's why i'm wearing the suit

99

00:03:44,550 --> 00:03:43,200

because when i'm taking samples i don't

100

00:03:46,789 --> 00:03:44,560

want to contaminate the samples i'm

101  
00:03:48,789 --> 00:03:46,799  
working with right right with your own

102  
00:03:50,390 --> 00:03:48,799  
skin cells and whatever by exactly

103  
00:03:52,470 --> 00:03:50,400  
falling off yeah we have a photo don't

104  
00:03:54,869 --> 00:03:52,480  
we i think so yeah mary beth in the

105  
00:03:56,789 --> 00:03:54,879  
atacama all right tell us what we're

106  
00:03:58,949 --> 00:03:56,799  
seeing here right so this is uh me

107  
00:04:01,110 --> 00:03:58,959  
taking a sample um from one of the

108  
00:04:02,789 --> 00:04:01,120  
driest places on the planet and here i'm

109  
00:04:05,350 --> 00:04:02,799  
trying to study the extreme limits of

110  
00:04:06,789 --> 00:04:05,360  
life and then trying to understand um

111  
00:04:09,509 --> 00:04:06,799  
whether any remnants of life get

112  
00:04:11,509 --> 00:04:09,519  
preserved in the fossil record oh wow so

113  
00:04:13,110 --> 00:04:11,519

you're talking about life like bacteria

114

00:04:15,589 --> 00:04:13,120  
and things like that yeah exactly

115

00:04:17,110 --> 00:04:15,599  
microscopic life okay so um we're

116

00:04:19,030 --> 00:04:17,120  
looking for the chemical evidence of

117

00:04:22,310 --> 00:04:19,040  
life that gets preserved in the rock

118

00:04:24,629 --> 00:04:22,320  
record and um specifically i'm studying

119

00:04:27,189 --> 00:04:24,639  
a type of molecule called lipid a lipid

120

00:04:28,469 --> 00:04:27,199  
so fats which we love to eat obviously

121

00:04:30,150 --> 00:04:28,479  
yes

122

00:04:32,070 --> 00:04:30,160  
and the cool thing about lipids is that

123

00:04:34,390 --> 00:04:32,080  
they're extremely well preserved in the

124

00:04:36,150 --> 00:04:34,400  
fossil record so if you look back at the

125

00:04:37,909 --> 00:04:36,160  
very oldest rocks on earth and you're

126

00:04:39,909 --> 00:04:37,919

looking for evidence of life you can

127

00:04:41,430 --> 00:04:39,919

still find some of the lipid molecules

128

00:04:43,270 --> 00:04:41,440

from those organisms that lived in those

129

00:04:45,749 --> 00:04:43,280

environments the first life on earth

130

00:04:48,469 --> 00:04:45,759

yeah you can find traces of it

131

00:04:50,310 --> 00:04:48,479

still around fascinating and so like um

132

00:04:52,230 --> 00:04:50,320

when we're thinking about um what we

133

00:04:53,990 --> 00:04:52,240

want to look for on mars we want to try

134

00:04:56,070 --> 00:04:54,000

to target these types of molecules they

135

00:04:58,469 --> 00:04:56,080

can live for that can stick around for

136

00:05:00,950 --> 00:04:58,479

really long periods of time because mars

137

00:05:02,950 --> 00:05:00,960

um used to have really nice conditions

138

00:05:05,189 --> 00:05:02,960

for life but like three billion years

139

00:05:07,749 --> 00:05:05,199

ago oh okay okay he used to have a

140

00:05:09,110 --> 00:05:07,759

thicker atmosphere and yeah liquid water

141

00:05:11,110 --> 00:05:09,120

on the surface and so we have to look

142

00:05:12,950 --> 00:05:11,120

for the remainder of what might have

143

00:05:14,870 --> 00:05:12,960

lived on mars right right if there were

144

00:05:16,710 --> 00:05:14,880

any little microbes right exactly what

145

00:05:18,550 --> 00:05:16,720

parts of them would survive that long

146

00:05:20,550 --> 00:05:18,560

that's what you're looking for yeah how

147

00:05:22,950 --> 00:05:20,560

do you use your tools here yeah okay so

148

00:05:24,790 --> 00:05:22,960

like um i'm kind of a cool

149

00:05:27,189 --> 00:05:24,800

hybrid scientist so i do a mix of

150

00:05:29,430 --> 00:05:27,199

geology and biochemistry so i have my

151  
00:05:31,270 --> 00:05:29,440  
handy rock hammer

152  
00:05:32,550 --> 00:05:31,280  
so i can break open the rocks and then

153  
00:05:37,430 --> 00:05:32,560  
for the really

154  
00:05:38,790 --> 00:05:37,440  
tricky samples we have a this is a drill

155  
00:05:40,550 --> 00:05:38,800  
string so you can see like i have some

156  
00:05:41,990 --> 00:05:40,560  
of the atacama still stuck on that yeah

157  
00:05:44,870 --> 00:05:42,000  
i see the red dust on there i've

158  
00:05:46,790 --> 00:05:44,880  
destroyed a few of these in my career

159  
00:05:49,350 --> 00:05:46,800  
and then once we get the stuff out of

160  
00:05:51,189 --> 00:05:49,360  
the rock we'll put it in our sample jar

161  
00:05:52,629 --> 00:05:51,199  
out in the desert

162  
00:05:54,790 --> 00:05:52,639  
soil samples and you get it in the

163  
00:05:57,029 --> 00:05:54,800

bottle there and i actually have a few

164

00:05:59,189 --> 00:05:57,039

samples from our last house

165

00:06:01,350 --> 00:05:59,199

she brought samples from the atacama

166

00:06:03,909 --> 00:06:01,360

these are some really cool samples that

167

00:06:07,510 --> 00:06:03,919

i collected wow from an ancient salt

168

00:06:09,990 --> 00:06:07,520

flat so this is a probably about uh a

169

00:06:11,590 --> 00:06:10,000

few million years old and you can see

170

00:06:13,350 --> 00:06:11,600

some of that black stuff in there those

171

00:06:14,390 --> 00:06:13,360

are some of the remnants of the life

172

00:06:17,909 --> 00:06:14,400

that lived

173

00:06:20,070 --> 00:06:17,919

in the body of water that formed this

174

00:06:22,469 --> 00:06:20,080

wow this is salt yeah this is almost

175

00:06:25,510 --> 00:06:22,479

pure salt yeah wow yeah so this took a

176

00:06:26,309 --> 00:06:25,520

couple drills to get out

177

00:06:27,990 --> 00:06:26,319

yeah

178

00:06:29,830 --> 00:06:28,000

so what do you guys do with the samples

179

00:06:32,390 --> 00:06:29,840

when you bring them back to the lab

180

00:06:33,749 --> 00:06:32,400

right yeah so we take back

181

00:06:36,390 --> 00:06:33,759

all the samples we're interested in and

182

00:06:38,469 --> 00:06:36,400

then i take them to my biochemistry lab

183

00:06:40,790 --> 00:06:38,479

here at nasa and um

184

00:06:42,790 --> 00:06:40,800

we dissolve the rock and we pull out all

185

00:06:45,189 --> 00:06:42,800

of the chemicals and then we study them

186

00:06:46,550 --> 00:06:45,199

with uh analytical instruments that tell

187

00:06:48,790 --> 00:06:46,560

us um

188

00:06:50,710 --> 00:06:48,800

a lot about the sample like what it who

189

00:06:52,710 --> 00:06:50,720

it is what it might have eaten like

190

00:06:54,870 --> 00:06:52,720

those things really that's information

191

00:06:57,110 --> 00:06:54,880

so we'll spend years studying a

192

00:06:59,110 --> 00:06:57,120

particular site and i did my whole phd

193

00:07:01,110 --> 00:06:59,120

in the atacama

194

00:07:03,029 --> 00:07:01,120

so i've worn these suits for a long time

195

00:07:04,710 --> 00:07:03,039

yeah you're very familiar with this

196

00:07:06,870 --> 00:07:04,720

outfit it doesn't bother you much huh oh

197

00:07:09,670 --> 00:07:06,880

gosh i think he you learned to love the

198

00:07:11,350 --> 00:07:09,680

heat i guess yeah yeah yeah like a few

199

00:07:13,749 --> 00:07:11,360

years ago when we went like the ground

200

00:07:15,430 --> 00:07:13,759

temperatures were like well over 100

201

00:07:33,110 --> 00:07:15,440

degrees so you know

202

00:07:36,230 --> 00:07:35,350

so i don't i don't think it's ever been

203

00:07:37,909 --> 00:07:36,240

uh

204

00:07:39,350 --> 00:07:37,919

ever been seen before maybe

205

00:07:40,950 --> 00:07:39,360

maybe a long time ago there may have

206

00:07:43,270 --> 00:07:40,960

been i'd have to look back at the

207

00:07:45,589 --> 00:07:43,280

literature but right now no like mars is

208

00:07:48,710 --> 00:07:45,599

one big giant desert and actually for

209

00:07:50,790 --> 00:07:48,720

comparison the atacama is a thousand

210

00:07:51,749 --> 00:07:50,800

times wetter

211

00:07:55,510 --> 00:07:51,759

than

212

00:07:56,790 --> 00:07:55,520

okay so the driest place on earth dries

213

00:07:58,230 --> 00:07:56,800

place on a thousand times the wetter

214

00:07:59,670 --> 00:07:58,240

than it's a thousand times wetter so

215

00:08:01,830 --> 00:07:59,680

it's like comparing the driest place on

216

00:08:04,790 --> 00:08:01,840

earth to the amazon that's the delta so

217

00:08:06,550 --> 00:08:04,800

mars is extremely dry wow wow yeah but

218

00:08:07,990 --> 00:08:06,560

but it's the best place you can practice

219

00:08:10,150 --> 00:08:08,000

on earth right it's a really good place

220

00:08:11,670 --> 00:08:10,160

to practice okay

221

00:08:13,749 --> 00:08:11,680

okay let me get through some more

222

00:08:17,830 --> 00:08:13,759

there's probably five in line for you

223

00:08:19,350 --> 00:08:17,840

here so speed racer 216. what material

224

00:08:20,790 --> 00:08:19,360

is the suit made of and does it keep

225

00:08:25,350 --> 00:08:20,800

cool

226

00:08:27,430 --> 00:08:25,360

and um they're special clean suits so

227

00:08:29,350 --> 00:08:27,440

like when you buy them there's uh very

228

00:08:31,830 --> 00:08:29,360

few microbes on it and it keeps all of

229

00:08:34,550 --> 00:08:31,840

your uh microbes on the inside and

230

00:08:36,310 --> 00:08:34,560

humans actually will um emit about a

231

00:08:38,709 --> 00:08:36,320

million particles per hour and that's

232

00:08:39,909 --> 00:08:38,719

like after showering really yeah exactly

233

00:08:41,589 --> 00:08:39,919

we're just shedding we're just shedding

234

00:08:43,909 --> 00:08:41,599

stuff we're shedding bacteria and

235

00:08:45,670 --> 00:08:43,919

organic molecules all the time so you

236

00:08:49,350 --> 00:08:45,680

can imagine if you're studying a sample

237

00:08:51,190 --> 00:08:49,360

that has maybe only a few hundred cells

238

00:08:53,030 --> 00:08:51,200

that a million cells is going to be like

239

00:08:54,070 --> 00:08:53,040

totally overwhelming

240

00:08:55,750 --> 00:08:54,080

you don't want to take that back to your

241

00:08:56,949 --> 00:08:55,760

lab and then analyze yourself like that

242

00:09:00,470 --> 00:08:56,959

right yeah

243

00:09:02,870 --> 00:09:01,350

okay

244

00:09:05,030 --> 00:09:02,880

uh let's see if you can give us a number

245

00:09:07,269 --> 00:09:05,040

for this balasparkle asks is there a

246

00:09:09,430 --> 00:09:07,279

percentage of how much less microscopic

247

00:09:11,350 --> 00:09:09,440

life there is in that desert compared to

248

00:09:12,790 --> 00:09:11,360

an average environment yeah so in an

249

00:09:13,829 --> 00:09:12,800

average environment like if you took

250

00:09:15,190 --> 00:09:13,839

like um

251

00:09:17,430 --> 00:09:15,200

the same amount of sea water you'd

252

00:09:19,030 --> 00:09:17,440

probably find about a million bacteria

253

00:09:20,630 --> 00:09:19,040

and compare that to the driest place in

254

00:09:22,630 --> 00:09:20,640

the atacama where you only find about a

255

00:09:25,750 --> 00:09:22,640

hundred so it's like

256

00:09:27,670 --> 00:09:25,760

significant that's ridiculous wow yeah

257

00:09:30,630 --> 00:09:27,680

we uh have a

258

00:09:33,350 --> 00:09:30,640

question here from z track uh how did

259

00:09:35,430 --> 00:09:33,360

you get a degree in this how did you

260

00:09:37,509 --> 00:09:35,440

what was your journey to become

261

00:09:39,829 --> 00:09:37,519

a scientist yes scientist

262

00:09:40,790 --> 00:09:39,839

i've loved geology since i was in first

263

00:09:43,590 --> 00:09:40,800

grade

264

00:09:44,870 --> 00:09:43,600

and i loved space two and um i actually

265

00:09:47,350 --> 00:09:44,880

got an internship here when i was in

266

00:09:48,790 --> 00:09:47,360

high school and then um i went to

267

00:09:50,470 --> 00:09:48,800

college and i studied geology and

268

00:09:52,790 --> 00:09:50,480

planetary science and then i went on to

269

00:09:55,829 --> 00:09:52,800

get my phd in earth and atmospheric

270

00:09:58,070 --> 00:09:55,839

sciences with a focus on biochemistry oh

271

00:09:59,670 --> 00:09:58,080

wow yeah but i think a lot about being a

272

00:10:01,350 --> 00:09:59,680

student is about being self-motivated

273

00:10:02,630 --> 00:10:01,360

and coming up with a set of questions

274

00:10:04,550 --> 00:10:02,640

that you're really interested in

275

00:10:06,710 --> 00:10:04,560

answering and then learning whatever you

276

00:10:08,470 --> 00:10:06,720

need to learn to pursue those questions

277

00:10:11,110 --> 00:10:08,480

whether that's geology or physics or

278

00:10:12,630 --> 00:10:11,120

chemistry or biology or even english and

279

00:10:15,110 --> 00:10:12,640

gosh i'll tell you being at nasa a lot

280

00:10:17,590 --> 00:10:15,120

of what i do is writing yes it's true

281

00:10:19,269 --> 00:10:17,600

isn't it yeah yeah yeah so there's no

282

00:10:20,470 --> 00:10:19,279

one right path it's

283

00:10:22,150 --> 00:10:20,480

follow what you want to do and do

284

00:10:23,990 --> 00:10:22,160

whatever you need to do right yeah

285

00:10:26,630 --> 00:10:24,000

exactly um

286

00:10:28,949 --> 00:10:26,640

let's take a couple quick ones andy mann

287

00:10:30,790 --> 00:10:28,959

says working at nasa is awesome

288

00:10:32,630 --> 00:10:30,800

it certainly sounds it if you're mary

289

00:10:34,150 --> 00:10:32,640

beth

290

00:10:36,710 --> 00:10:34,160

um

291

00:10:39,750 --> 00:10:36,720

ian is a d-bag so she's wearing her work

292

00:10:41,670 --> 00:10:39,760

outfit is his question so to clarify yes

293

00:10:43,110 --> 00:10:41,680

indeed you do work in this yeah so this

294

00:10:45,110 --> 00:10:43,120

is what i wear when i'm

295

00:10:47,030 --> 00:10:45,120

doing field work in the atacama but

296

00:10:49,670 --> 00:10:47,040

actually i did do some work once in this

297

00:10:51,110 --> 00:10:49,680

um ancient dna laboratory where people

298

00:10:52,790 --> 00:10:51,120

have to wear suits like this probably

299

00:10:54,069 --> 00:10:52,800

even more restrictive with complete

300

00:10:55,350 --> 00:10:54,079

coveralls

301

00:10:57,269 --> 00:10:55,360

every day while they're doing

302

00:10:59,509 --> 00:10:57,279

extractions from really precious samples

303

00:11:01,910 --> 00:10:59,519

they don't want to contaminate okay yeah

304

00:11:04,069 --> 00:11:01,920

all right so yes this is mary beth's

305

00:11:06,470 --> 00:11:04,079

real work outfit but if you want this to

306

00:11:08,470 --> 00:11:06,480

be your halloween costume

307

00:11:10,389 --> 00:11:08,480

can you help us figure out some ways we

308

00:11:11,829 --> 00:11:10,399

could recreate this look absolutely i

309

00:11:13,269 --> 00:11:11,839

think it's going to take a good trip to

310

00:11:15,430 --> 00:11:13,279

the hardware store

311

00:11:17,590 --> 00:11:15,440

you gotta get some drill bits yeah right

312

00:11:18,949 --> 00:11:17,600

coveralls yeah a lot of what i buy is

313

00:11:21,190 --> 00:11:18,959

actually from the hardware store really

314

00:11:23,430 --> 00:11:21,200

yeah yeah it makes sense yeah it's all

315

00:11:24,790 --> 00:11:23,440

the same stuff yeah yeah yeah getting

316

00:11:26,470 --> 00:11:24,800

your hands dirty out there for sure

317

00:11:29,030 --> 00:11:26,480

right

318

00:11:30,389 --> 00:11:29,040

well awesome thank you guys for joining

319

00:11:32,550 --> 00:11:30,399

us answering questions we're going to

320

00:11:34,069 --> 00:11:32,560

bring you back later on for the voting

321

00:11:34,790 --> 00:11:34,079

system

322

00:11:36,790 --> 00:11:34,800

but

323

00:11:38,389 --> 00:11:36,800

thank you for bringing your samples and

324

00:11:39,590 --> 00:11:38,399

your tools

325

00:11:43,190 --> 00:11:39,600

and we will

326

00:11:45,829 --> 00:11:43,200

see you in a bit all right thanks guys

327

00:11:48,550 --> 00:11:45,839

super cool pretty impressive yes yes and

328

00:11:50,550 --> 00:11:48,560

but you know doable i feel like i could

329

00:11:52,150 --> 00:11:50,560

put together that costume yeah if i

330

00:11:54,949 --> 00:11:52,160

could be mary beth one day you know for

331

00:11:57,110 --> 00:11:54,959

one day why not don't you want her

332

00:11:58,870 --> 00:11:57,120

yeah i always wanted to be mary beth

333

00:12:01,110 --> 00:11:58,880

halloween is my day

334

00:12:04,710 --> 00:12:01,120

awesome all right let's move on to our

335

00:12:06,600 --> 00:12:04,720

next contender up next we have chuck

336

00:12:15,430 --> 00:12:06,610

come on out chuck

337

00:12:16,790 --> 00:12:15,440

[Music]

338

00:12:20,870 --> 00:12:16,800

excellent

339

00:12:24,150 --> 00:12:20,880

hello hi i see a lab coat oh yeah some

340

00:12:25,670 --> 00:12:24,160

gloves dust and dirt some gloves

341

00:12:26,470 --> 00:12:25,680

feel free to come right on up to the

342

00:12:28,389 --> 00:12:26,480

table

343

00:12:29,269 --> 00:12:28,399

those chairs are hard to tuck in there

344

00:12:31,190 --> 00:12:29,279

we go

345

00:12:33,430 --> 00:12:31,200

all right how's that good uh tell us

346

00:12:35,269 --> 00:12:33,440

your name and what you do here at sure

347

00:12:37,030 --> 00:12:35,279

my name is chuck horn ellison i'm a

348

00:12:39,190 --> 00:12:37,040

mechanical engineer and i work in the

349

00:12:40,150 --> 00:12:39,200

ballistic ranges here at ames research

350

00:12:41,750 --> 00:12:40,160

center

351  
00:12:43,350 --> 00:12:41,760  
sounds quite interesting we'll hear more

352  
00:12:45,190 --> 00:12:43,360  
about that in a second sure first of all

353  
00:12:47,670 --> 00:12:45,200  
just tell us what you're wearing

354  
00:12:49,829 --> 00:12:47,680  
i'm wearing uh basically the standard

355  
00:12:51,509 --> 00:12:49,839  
attire we wear when we're conducting

356  
00:12:52,470 --> 00:12:51,519  
experiments in the ballistic ranges it's

357  
00:12:59,670 --> 00:12:52,480  
a

358  
00:13:01,990 --> 00:12:59,680  
we

359  
00:13:04,310 --> 00:13:02,000  
typically handle explosives and and

360  
00:13:06,629 --> 00:13:04,320  
various hazardous materials so we have

361  
00:13:08,069 --> 00:13:06,639  
the safety accoutrement you know yes

362  
00:13:09,110 --> 00:13:08,079  
glasses

363  
00:13:10,550 --> 00:13:09,120

all these things yeah you want to go

364

00:13:12,310 --> 00:13:10,560

home with the same number of fingers and

365

00:13:13,910 --> 00:13:12,320

eyebrows that you come in with so that's

366

00:13:15,590 --> 00:13:13,920

the goal so this is yeah standard

367

00:13:19,350 --> 00:13:15,600

ballistic range attire it's been

368

00:13:23,110 --> 00:13:21,670

designer lab that's that's right okay so

369

00:13:25,509 --> 00:13:23,120

you're dirty and you work with

370

00:13:27,030 --> 00:13:25,519

explosives what exactly is going on

371

00:13:29,110 --> 00:13:27,040

ballistic range well the ballistic

372

00:13:30,870 --> 00:13:29,120

ranges there's actually two facilities

373

00:13:32,710 --> 00:13:30,880

within the ballistic range complex that

374

00:13:34,310 --> 00:13:32,720

are currently active

375

00:13:36,310 --> 00:13:34,320

one of them's called the ames vertical

376

00:13:37,829 --> 00:13:36,320

gun range and what we do there is we use

377

00:13:40,310 --> 00:13:37,839

a large gun to shoot high-speed

378

00:13:42,150 --> 00:13:40,320

projectiles into targets to simulate

379

00:13:44,150 --> 00:13:42,160

what happens when an asteroid or a

380

00:13:46,069 --> 00:13:44,160

meteor impacts a planet or moon surface

381

00:13:48,790 --> 00:13:46,079

we observe the formation of the crater

382

00:13:51,110 --> 00:13:48,800

where the debris goes etc in fact i've

383

00:13:53,509 --> 00:13:51,120

got a a brief uh video that demonstrates

384

00:13:55,430 --> 00:13:53,519

yes you see that video there you go

385

00:13:56,949 --> 00:13:55,440

there is the blue chambers where we

386

00:13:59,750 --> 00:13:56,959

place our targets and adjust the

387

00:14:01,189 --> 00:13:59,760

environment according to whatever um

388

00:14:03,590 --> 00:14:01,199

conditions we're trying to simulate the

389

00:14:05,990 --> 00:14:03,600

orange section was our our gun beam

390

00:14:08,550 --> 00:14:06,000

there's a nice impact you see the

391

00:14:10,710 --> 00:14:08,560

the crate the debris curtain evolving

392

00:14:12,949 --> 00:14:10,720

and as materials being excavated and as

393

00:14:15,030 --> 00:14:12,959

soon as the smoke clears voila there you

394

00:14:16,790 --> 00:14:15,040

go there's the crater i see it i see it

395

00:14:19,430 --> 00:14:16,800

yeah yeah that's not your

396

00:14:21,670 --> 00:14:19,440

regular gun no no no it's not not a

397

00:14:23,750 --> 00:14:21,680

typical gun it's it's uh what we use is

398

00:14:25,990 --> 00:14:23,760

what's called a two-stage light gas gun

399

00:14:28,710 --> 00:14:26,000

and the way it operates is you you use

400

00:14:30,230 --> 00:14:28,720

gun powder to shoot a piston down a tube

401  
00:14:32,550 --> 00:14:30,240  
that's filled with hydrogen and as the

402  
00:14:35,030 --> 00:14:32,560  
piston traverses the tube it compresses

403  
00:14:36,949 --> 00:14:35,040  
the hydrogen to extreme pressure

404  
00:14:37,829 --> 00:14:36,959  
tens of thousands of pounds per square

405  
00:14:39,670 --> 00:14:37,839  
inch

406  
00:14:41,430 --> 00:14:39,680  
and we then use that high pressure

407  
00:14:43,189 --> 00:14:41,440  
hydrogen as our propellant medium or

408  
00:14:45,590 --> 00:14:43,199  
what we use to

409  
00:14:47,110 --> 00:14:45,600  
launch the bullet out of our gun barrel

410  
00:14:49,110 --> 00:14:47,120  
and the reason we do that is you can get

411  
00:14:50,870 --> 00:14:49,120  
much higher velocities than you can with

412  
00:14:53,750 --> 00:14:50,880  
a standard gun

413  
00:14:55,509 --> 00:14:53,760

our guns in the range complex top out at

414

00:14:56,230 --> 00:14:55,519

about eight kilometers per second which

415

00:14:58,949 --> 00:14:56,240

is

416

00:15:00,310 --> 00:14:58,959

roughly eighteen 000 miles per hour or

417

00:15:02,069 --> 00:15:00,320

this way if you're traveling that speed

418

00:15:04,310 --> 00:15:02,079

you could fly from san francisco to new

419

00:15:06,230 --> 00:15:04,320

york in about 10 minutes oh wow that's a

420

00:15:09,030 --> 00:15:06,240

little fun fact for you we are in fact

421

00:15:10,389 --> 00:15:09,040

the fastest gun in the west yes

422

00:15:12,069 --> 00:15:10,399

yes

423

00:15:13,910 --> 00:15:12,079

excellent

424

00:15:15,670 --> 00:15:13,920

so that's that's the vertical gun range

425

00:15:16,790 --> 00:15:15,680

okay and i know you have you have

426

00:15:17,590 --> 00:15:16,800

another one yeah i want to hear about

427

00:15:19,269 --> 00:15:17,600

that

428

00:15:22,389 --> 00:15:19,279

we have some hellos for you if i could

429

00:15:24,310 --> 00:15:22,399

okay just jump into the chat here as daz

430

00:15:28,310 --> 00:15:24,320

x3 hey chuck

431

00:15:30,069 --> 00:15:28,320

hello caps big hello um speed razor 216

432

00:15:32,389 --> 00:15:30,079

are those mechanics gloves i love those

433

00:15:33,829 --> 00:15:32,399

gloves yeah let's see we have we have

434

00:15:35,749 --> 00:15:33,839

various types of gloves i don't know if

435

00:15:37,829 --> 00:15:35,759

they want to you know depending on what

436

00:15:38,870 --> 00:15:37,839

we're trying to do uh some of them have

437

00:15:42,069 --> 00:15:38,880

this uh

438

00:15:43,590 --> 00:15:42,079

you know geico geico gecko like texture

439

00:15:46,150 --> 00:15:43,600

yes in addition to working in the

440

00:15:47,509 --> 00:15:46,160

ballistic ranges i can save you 15 on

441

00:15:49,910 --> 00:15:47,519

your car

442

00:15:51,829 --> 00:15:49,920

it's um we have text you know to improve

443

00:15:54,069 --> 00:15:51,839

manual dexterity depending on what what

444

00:15:55,350 --> 00:15:54,079

you're doing okay yeah and what sort of

445

00:15:57,030 --> 00:15:55,360

chemicals you're working with because

446

00:15:59,189 --> 00:15:57,040

you want to protect your your skin and

447

00:16:02,310 --> 00:15:59,199

whatnot from acetone

448

00:16:04,470 --> 00:16:02,320

cool sleepy underscore gary so cool yeah

449

00:16:06,069 --> 00:16:04,480

totally angry um

450

00:16:07,430 --> 00:16:06,079

and i know

451  
00:16:08,870 --> 00:16:07,440  
we're gonna hear more about the other

452  
00:16:09,910 --> 00:16:08,880  
facilities so let's do that first sure

453  
00:16:11,509 --> 00:16:09,920  
let's see if you answer some of these

454  
00:16:13,030 --> 00:16:11,519  
questions okay that the vertical gun

455  
00:16:15,110 --> 00:16:13,040  
that was uh

456  
00:16:17,269 --> 00:16:15,120  
range number one i think hyper velocity

457  
00:16:19,110 --> 00:16:17,279  
impact testing the other facilities

458  
00:16:21,269 --> 00:16:19,120  
called the hypervelocity free flight

459  
00:16:23,350 --> 00:16:21,279  
facility uh we use the same sort of gun

460  
00:16:25,189 --> 00:16:23,360  
technology but rather than

461  
00:16:27,430 --> 00:16:25,199  
looking at the impact we shoot

462  
00:16:30,230 --> 00:16:27,440  
small-scale models uh planetary entry

463  
00:16:31,910 --> 00:16:30,240

vehicles down a along flight corridor uh

464

00:16:34,949 --> 00:16:31,920

we take a lot a lot of pictures of them

465

00:16:36,629 --> 00:16:34,959

as they fly to to map out the trajectory

466

00:16:39,030 --> 00:16:36,639

and from that information we can infer

467

00:16:41,110 --> 00:16:39,040

the aerodynamic characteristics of these

468

00:16:44,470 --> 00:16:41,120

uh planetary entry vehicles and i have

469

00:16:47,350 --> 00:16:44,480

one right here yeah this um

470

00:16:49,030 --> 00:16:47,360

this is a picture of one of the

471

00:16:51,749 --> 00:16:49,040

models that we've we've shot over the

472

00:16:53,269 --> 00:16:51,759

years now it may look uh like some sort

473

00:16:55,110 --> 00:16:53,279

of a drawer pull that you would buy at

474

00:16:57,670 --> 00:16:55,120

home depot you know for five bucks but i

475

00:17:00,790 --> 00:16:57,680

assure you this is actually a a precise

476  
00:17:03,829 --> 00:17:00,800  
uh scale model of the orion capsule yeah

477  
00:17:06,390 --> 00:17:03,839  
and so we do have a video of of one of

478  
00:17:08,150 --> 00:17:06,400  
these tests these arrow ballistic tests

479  
00:17:09,990 --> 00:17:08,160  
let's see that let's have a look there

480  
00:17:11,270 --> 00:17:10,000  
you go there's the test section notice

481  
00:17:12,470 --> 00:17:11,280  
all the windows

482  
00:17:14,390 --> 00:17:12,480  
that's one of the reasons you get dirty

483  
00:17:17,429 --> 00:17:14,400  
you have 64 windows to clean after every

484  
00:17:19,110 --> 00:17:17,439  
test and uh we we launched the models

485  
00:17:20,150 --> 00:17:19,120  
here's here's a video of a model in

486  
00:17:22,549 --> 00:17:20,160  
flight

487  
00:17:24,789 --> 00:17:22,559  
and we take uh 32 still images from

488  
00:17:26,069 --> 00:17:24,799

which we can map out the trajectory and

489

00:17:28,069 --> 00:17:26,079

one thing

490

00:17:29,510 --> 00:17:28,079

there goes in a blaze of glory i do need

491

00:17:31,110 --> 00:17:29,520

blaze you know you can see it's burning

492

00:17:32,390 --> 00:17:31,120

there yeah one thing that was kind of

493

00:17:33,590 --> 00:17:32,400

cool from that video you probably

494

00:17:35,110 --> 00:17:33,600

noticed

495

00:17:37,110 --> 00:17:35,120

was the gas cap in front of the model

496

00:17:39,510 --> 00:17:37,120

was was glowing and even though we were

497

00:17:41,110 --> 00:17:39,520

simulating flight you know way up high

498

00:17:42,470 --> 00:17:41,120

in the atmosphere

499

00:17:45,110 --> 00:17:42,480

where it's fairly

500

00:17:47,270 --> 00:17:45,120

thin and not a lot of air molecules the

501  
00:17:48,870 --> 00:17:47,280  
fact you're traveling say 25 times the

502  
00:17:50,150 --> 00:17:48,880  
speed of sound you're still compressing

503  
00:17:51,830 --> 00:17:50,160  
and heating this gas to extreme

504  
00:17:54,310 --> 00:17:51,840  
temperatures and that's what causes it

505  
00:17:55,830 --> 00:17:54,320  
to glow like that which is a nice visual

506  
00:17:56,950 --> 00:17:55,840  
indication why you need to have a heat

507  
00:17:58,710 --> 00:17:56,960  
shield on your vehicle when you're

508  
00:18:00,789 --> 00:17:58,720  
entering the planet's atmosphere that's

509  
00:18:03,110 --> 00:18:00,799  
a wise precaution so so that that's the

510  
00:18:06,630 --> 00:18:03,120  
that's the free flight range um it's

511  
00:18:08,870 --> 00:18:06,640  
it's geared towards aerodynamics um

512  
00:18:10,710 --> 00:18:08,880  
we've been in business or that facility

513  
00:18:13,669 --> 00:18:10,720

not me but the facility's been in

514

00:18:15,510 --> 00:18:13,679

business since uh mid 60s oh wow um it

515

00:18:17,270 --> 00:18:15,520

started off supporting apollo and

516

00:18:19,430 --> 00:18:17,280

virtually with just a few

517

00:18:21,669 --> 00:18:19,440

exceptions every nasa probe that's

518

00:18:23,669 --> 00:18:21,679

entered a planet's atmosphere has had

519

00:18:25,510 --> 00:18:23,679

some sort of testing done in the

520

00:18:26,230 --> 00:18:25,520

ballistic range complex

521

00:18:27,990 --> 00:18:26,240

wow

522

00:18:30,150 --> 00:18:28,000

we've also been involved with some

523

00:18:32,390 --> 00:18:30,160

private industries such as spacex dragon

524

00:18:33,830 --> 00:18:32,400

capsule and blue origin the new shepard

525

00:18:36,390 --> 00:18:33,840

capsule so

526

00:18:38,070 --> 00:18:36,400

basically my team and i we provide a

527

00:18:39,669 --> 00:18:38,080

testing service we we operate the

528

00:18:42,230 --> 00:18:39,679

facility we conduct the tests for

529

00:18:43,590 --> 00:18:42,240

visiting researchers who pay for access

530

00:18:44,950 --> 00:18:43,600

and then we deliver the data and then

531

00:18:47,350 --> 00:18:44,960

they go off publish their papers

532

00:18:52,310 --> 00:18:47,360

whatever yeah so in that sense uh we

533

00:19:04,310 --> 00:18:53,590

i love it

534

00:19:10,870 --> 00:19:06,070

we need that western intro for him too

535

00:19:15,190 --> 00:19:13,590

all right next year i can't wait uh i

536

00:19:16,870 --> 00:19:15,200

have some more questions for you sure

537

00:19:18,230 --> 00:19:16,880

all right

538

00:19:20,789 --> 00:19:18,240

shoot

539

00:19:22,470 --> 00:19:20,799

says the fastest gun in the west

540

00:19:25,190 --> 00:19:22,480

um

541

00:19:27,990 --> 00:19:25,200

ho third asks again do you use lasers no

542

00:19:30,549 --> 00:19:28,000

yes do you use lasers oh we do use

543

00:19:32,789 --> 00:19:30,559

lasers for various applications um for

544

00:19:34,950 --> 00:19:32,799

example in the vertical gun range we use

545

00:19:36,630 --> 00:19:34,960

lasers for our model detection system

546

00:19:38,870 --> 00:19:36,640

that is to

547

00:19:40,630 --> 00:19:38,880

we have laser light sheets at specific

548

00:19:43,430 --> 00:19:40,640

distances and when the particle passes

549

00:19:45,270 --> 00:19:43,440

through these beams they stop uh timers

550

00:19:47,350 --> 00:19:45,280

so knowing the the time elapsed and the

551  
00:19:49,190 --> 00:19:47,360  
distance traveled you can then calculate

552  
00:19:51,190 --> 00:19:49,200  
the velocity so that that's how we

553  
00:19:53,270 --> 00:19:51,200  
measure the velocity of our car so

554  
00:19:56,710 --> 00:19:53,280  
that's one application

555  
00:20:00,549 --> 00:19:56,720  
nice um i'll stick 6e asks is the gun

556  
00:20:01,590 --> 00:20:00,559  
test performed in a vacuum uh yes um

557  
00:20:04,549 --> 00:20:01,600  
both

558  
00:20:07,190 --> 00:20:04,559  
they're vacuum chambers so you can you

559  
00:20:09,029 --> 00:20:07,200  
can pump the pressure way down and the

560  
00:20:11,270 --> 00:20:09,039  
vertical gun you can simulate impact on

561  
00:20:13,110 --> 00:20:11,280  
an airless body or you can backfill with

562  
00:20:15,510 --> 00:20:13,120  
different test gases if let's say if

563  
00:20:16,870 --> 00:20:15,520

you're simulating an impact on mars for

564

00:20:19,110 --> 00:20:16,880

example you can put a low level of

565

00:20:21,750 --> 00:20:19,120

carbon dioxide in there so we we can

566

00:20:23,669 --> 00:20:21,760

test it vacuum or in variable uh gases

567

00:20:24,549 --> 00:20:23,679

for different atmospheres all right

568

00:20:28,390 --> 00:20:24,559

sweet

569

00:20:29,990 --> 00:20:28,400

all right uh as that x3 says our axe

570

00:20:31,029 --> 00:20:30,000

what is the craziest experiment you've

571

00:20:32,070 --> 00:20:31,039

ever done

572

00:20:33,590 --> 00:20:32,080

ooh

573

00:20:34,870 --> 00:20:33,600

craziest

574

00:20:36,549 --> 00:20:34,880

well let's see there there's a couple

575

00:20:38,630 --> 00:20:36,559

that come to mind

576

00:20:40,789 --> 00:20:38,640

uh one that was fun this was a couple

577

00:20:43,750 --> 00:20:40,799

decades ago we were we had a researcher

578

00:20:44,870 --> 00:20:43,760

who is uh simulating uh the impact that

579

00:20:46,470 --> 00:20:44,880

that uh

580

00:20:48,950 --> 00:20:46,480

we believe triggered the extinction of

581

00:20:51,909 --> 00:20:48,960

the dinosaurs 65 million years ago you

582

00:20:54,230 --> 00:20:51,919

had this mount ever sized um asteroid

583

00:20:56,230 --> 00:20:54,240

that slammed into uh just off the coast

584

00:20:58,549 --> 00:20:56,240

of the yucatan and caused a big crater

585

00:21:00,070 --> 00:20:58,559

and so that was that was a very cool

586

00:21:02,390 --> 00:21:00,080

uh project because

587

00:21:04,149 --> 00:21:02,400

what he demonstrated was if the impact

588

00:21:05,909 --> 00:21:04,159

would come straight in normal to the

589

00:21:07,590 --> 00:21:05,919

earth most of the ejected material would

590

00:21:09,669 --> 00:21:07,600

have gone straight back up out into

591

00:21:11,990 --> 00:21:09,679

space but looking at the shape of the

592

00:21:13,750 --> 00:21:12,000

crater and the iridium deposits that

593

00:21:16,310 --> 00:21:13,760

came from the impactor and the way

594

00:21:18,149 --> 00:21:16,320

they're scattered across the earth it

595

00:21:20,070 --> 00:21:18,159

would indicate that it came in at a very

596

00:21:22,789 --> 00:21:20,080

shallow angle and because of that you

597

00:21:24,310 --> 00:21:22,799

had this wall of destruction of material

598

00:21:25,830 --> 00:21:24,320

going into the northern hemisphere and

599

00:21:27,350 --> 00:21:25,840

then a lot of stuff getting entrained in

600

00:21:29,510 --> 00:21:27,360

the atmosphere

601  
00:21:32,070 --> 00:21:29,520  
that caused dramatic climatic changes so

602  
00:21:33,669 --> 00:21:32,080  
what he was showing was that you know if

603  
00:21:35,190 --> 00:21:33,679  
we might we we might not be here and

604  
00:21:36,549 --> 00:21:35,200  
dinosaurs might still be around if it

605  
00:21:37,750 --> 00:21:36,559  
had come in in a different angle you

606  
00:21:39,430 --> 00:21:37,760  
know so

607  
00:21:41,830 --> 00:21:39,440  
that was that was a really really good

608  
00:21:45,909 --> 00:21:41,840  
that's a great example i know right

609  
00:21:48,310 --> 00:21:47,029  
we're gonna have to let you go really

610  
00:21:50,549 --> 00:21:48,320  
soon but there are two more good

611  
00:21:53,270 --> 00:21:50,559  
questions so we'll do a rapid fire thing

612  
00:21:55,590 --> 00:21:53,280  
here and nikki cakes asks can we shoot a

613  
00:21:57,350 --> 00:21:55,600

spacecraft at another planet or towards

614

00:22:00,230 --> 00:21:57,360

another planet instead of using rockets

615

00:22:01,669 --> 00:22:00,240

ah well from from the surface of earth

616

00:22:03,029 --> 00:22:01,679

that would be very difficult because you

617

00:22:05,350 --> 00:22:03,039

you know you've got gravity and you've

618

00:22:07,830 --> 00:22:05,360

got the atmosphere to get through and so

619

00:22:10,470 --> 00:22:07,840

they've been trying to use um

620

00:22:12,950 --> 00:22:10,480

uh like guns to launch satellites into

621

00:22:15,830 --> 00:22:12,960

space and it's really not a very uh

622

00:22:18,390 --> 00:22:15,840

feasible uh means of doing so

623

00:22:20,310 --> 00:22:18,400

um maybe if you built something you know

624

00:22:21,669 --> 00:22:20,320

that's an orbital platform and launched

625

00:22:23,430 --> 00:22:21,679

it from there that might be a good way

626  
00:22:25,110 --> 00:22:23,440  
to get it there but uh from the surface

627  
00:22:27,029 --> 00:22:25,120  
of planet that now that would be a tough

628  
00:22:28,470 --> 00:22:27,039  
sell yeah too much atmosphere to get

629  
00:22:30,230 --> 00:22:28,480  
through yeah

630  
00:22:33,510 --> 00:22:30,240  
you want to take the last one

631  
00:22:34,310 --> 00:22:33,520  
ah yes so we have scary crazy butter

632  
00:22:36,549 --> 00:22:34,320  
knife

633  
00:22:38,230 --> 00:22:36,559  
here

634  
00:22:41,270 --> 00:22:38,240  
chuck have you done any impact or

635  
00:22:43,909 --> 00:22:41,280  
microscopic impact testing on spacecraft

636  
00:22:46,470 --> 00:22:43,919  
yes yes we have um

637  
00:22:48,390 --> 00:22:46,480  
the cassini mission mars rovers and we

638  
00:22:51,830 --> 00:22:48,400

looked at some vehicle survivability or

639

00:22:53,750 --> 00:22:51,840

vulnerability uh tests where we we took

640

00:22:55,190 --> 00:22:53,760

jpl came to us with certain components

641

00:22:56,470 --> 00:22:55,200

of the spacecraft they were concerned

642

00:22:58,310 --> 00:22:56,480

about to see if they had adequate

643

00:22:59,909 --> 00:22:58,320

shielding so we replicated

644

00:23:01,990 --> 00:22:59,919

micrometeoroid impacts on those

645

00:23:04,310 --> 00:23:02,000

components so you could so they could

646

00:23:05,750 --> 00:23:04,320

get a better probabilistic model of what

647

00:23:08,470 --> 00:23:05,760

sort of uh

648

00:23:10,630 --> 00:23:08,480

survivability the vehicle uh or how

649

00:23:12,710 --> 00:23:10,640

likely would this vehicle survive uh

650

00:23:14,630 --> 00:23:12,720

getting to its destination so we we have

651

00:23:16,549 --> 00:23:14,640

done some micrometeoroid

652

00:23:17,990 --> 00:23:16,559

impact tests on spacecraft yeah that's

653

00:23:21,190 --> 00:23:18,000

so awesome you do so many different

654

00:23:22,710 --> 00:23:21,200

kinds of things in there yeah facility

655

00:23:24,950 --> 00:23:22,720

that sounds very cool cool well thank

656

00:23:27,190 --> 00:23:24,960

you for coming sharing it all with us

657

00:23:28,630 --> 00:23:27,200

now you get out of here for now and

658

00:23:30,630 --> 00:23:28,640

we're going to invite you back later

659

00:23:32,149 --> 00:23:30,640

when it's time to vote okay all right

660

00:23:33,510 --> 00:23:32,159

thanks for coming on check it my

661

00:23:35,669 --> 00:23:33,520

pleasure all right

662

00:23:37,909 --> 00:23:35,679

did you know half of that stuff nope but

663

00:23:39,669 --> 00:23:37,919

they were not there i knew

664

00:23:41,990 --> 00:23:39,679

i knew they did the impact yeah crater

665

00:23:43,669 --> 00:23:42,000

formation yeah but the dinosaur

666

00:23:45,110 --> 00:23:43,679

research that's like so cool who would

667

00:23:47,029 --> 00:23:45,120

you ever think right i learned so much

668

00:23:49,430 --> 00:23:47,039

on the show i know

669

00:23:52,630 --> 00:23:49,440

that's why i love it so let's move on

670

00:23:59,190 --> 00:23:52,640

and learn some more from our next guest

671

00:24:02,830 --> 00:24:00,470

hey there

672

00:24:06,390 --> 00:24:04,549

okay

673

00:24:09,269 --> 00:24:06,400

3d glasses

674

00:24:11,909 --> 00:24:09,279

cool nasa shirt i see

675

00:24:13,510 --> 00:24:11,919

welcome scoot right in there yeah get

676

00:24:15,190 --> 00:24:13,520

nice and close to the mic

677

00:24:16,950 --> 00:24:15,200

yeah all right so why don't you tell

678

00:24:19,590 --> 00:24:16,960

everybody your name and what you do here

679

00:24:21,430 --> 00:24:19,600

at ames so i'm lynn lee st george and i

680

00:24:23,669 --> 00:24:21,440

am an intern here at ames working with

681

00:24:27,510 --> 00:24:23,679

the intelligent robotics group creating

682

00:24:29,190 --> 00:24:27,520

uh 3d visualizations using novel media

683

00:24:31,750 --> 00:24:29,200

particularly of geological and

684

00:24:33,669 --> 00:24:31,760

geospatial data oh wow sounds really

685

00:24:35,510 --> 00:24:33,679

cool all right uh well we're gonna hear

686

00:24:38,470 --> 00:24:35,520

more about that i hope later

687

00:24:40,789 --> 00:24:38,480

describe for us your attire today uh so

688

00:24:42,630 --> 00:24:40,799

i'm dressed as a regular intern in my

689

00:24:44,549 --> 00:24:42,640

normal everyday outfit so we get a lot

690

00:25:02,230 --> 00:24:44,559

of uh personal expression with how we

691

00:25:07,110 --> 00:25:03,750

tell us a little bit about what you're

692

00:25:09,430 --> 00:25:07,120

working on 3d printers 3d glasses what

693

00:25:12,470 --> 00:25:09,440

are you working on uh so i work on

694

00:25:14,710 --> 00:25:12,480

creating um 3d visualizations including

695

00:25:17,110 --> 00:25:14,720

3d printed models

696

00:25:19,669 --> 00:25:17,120

um maybe if you hold that still there

697

00:25:22,870 --> 00:25:19,679

yeah jesse could get a close-up on a

698

00:25:26,549 --> 00:25:22,880

3d printed model of what uh so this is a

699

00:25:28,950 --> 00:25:26,559

borehole drilled by curiosity and uh it

700

00:25:31,510 --> 00:25:28,960

was create this 3d model was created

701  
00:25:33,990 --> 00:25:31,520  
from stereoscopic images that it took of

702  
00:25:36,310 --> 00:25:34,000  
that borehole so the different angles

703  
00:25:38,070 --> 00:25:36,320  
okay the rover on mars is drilling it's

704  
00:25:40,390 --> 00:25:38,080  
drilling the bore holes to see if it can

705  
00:25:42,630 --> 00:25:40,400  
get um samples from i believe they're

706  
00:25:44,870 --> 00:25:42,640  
called mudstones to see what kind of

707  
00:25:46,950 --> 00:25:44,880  
chemicals and um

708  
00:25:49,269 --> 00:25:46,960  
if there's any proteins or anything sort

709  
00:25:52,390 --> 00:25:49,279  
of like in the in those rocks

710  
00:25:54,310 --> 00:25:52,400  
um and so curiosity rovers ingale crater

711  
00:25:56,230 --> 00:25:54,320  
creating these boreholes

712  
00:25:58,310 --> 00:25:56,240  
and taking stereoscopic images which are

713  
00:26:00,870 --> 00:25:58,320

images from two angles and from that you

714

00:26:02,390 --> 00:26:00,880

can create um this is an incomplete 3d

715

00:26:03,590 --> 00:26:02,400

mesh so if you hold it the right angle

716

00:26:04,549 --> 00:26:03,600

there's actually little holes in the

717

00:26:07,110 --> 00:26:04,559

bottom

718

00:26:09,029 --> 00:26:07,120

and fixing those holes and seeing the

719

00:26:12,390 --> 00:26:09,039

best ways to take photos to get complete

720

00:26:14,390 --> 00:26:12,400

meshes as part of what i do

721

00:26:17,990 --> 00:26:14,400

but mostly what i do is i take various

722

00:26:20,470 --> 00:26:18,000

stereoscopic images and use 3d printing

723

00:26:21,269 --> 00:26:20,480

and holograms and augmented reality to

724

00:26:23,909 --> 00:26:21,279

see

725

00:26:25,750 --> 00:26:23,919

what types of visualizations we can make

726

00:26:28,230 --> 00:26:25,760

in the hopes that scientists who we

727

00:26:30,470 --> 00:26:28,240

can't just casually drop off on mars

728

00:26:32,470 --> 00:26:30,480

can make earth-like observations so

729

00:26:34,710 --> 00:26:32,480

observations like mary beth earlier was

730

00:26:37,510 --> 00:26:34,720

making in the desert using just these

731

00:26:39,510 --> 00:26:37,520

images that we've collected uh from mars

732

00:26:41,590 --> 00:26:39,520

wow okay right so scientists on earth

733

00:26:43,590 --> 00:26:41,600

could be yeah watching what can be

734

00:26:45,830 --> 00:26:43,600

watching through the rover and making

735

00:26:47,669 --> 00:26:45,840

correct scientific observations awesome

736

00:26:49,269 --> 00:26:47,679

yeah yeah so you're you're just getting

737

00:26:50,710 --> 00:26:49,279

started in your internship and you're

738

00:26:53,269 --> 00:26:50,720

showing us some examples the kinds of

739

00:26:55,909 --> 00:26:53,279

work that you're going to be yeah so

740

00:26:57,990 --> 00:26:55,919

this is just a test print um we're doing

741

00:26:59,990 --> 00:26:58,000

things like creating multi-material

742

00:27:02,149 --> 00:27:00,000

multicolored prints that will have more

743

00:27:03,350 --> 00:27:02,159

realistic effects

744

00:27:05,990 --> 00:27:03,360

and one of the things that we're most

745

00:27:08,390 --> 00:27:06,000

focused on is realistic optical effects

746

00:27:10,710 --> 00:27:08,400

uh because it's very difficult in just a

747

00:27:11,590 --> 00:27:10,720

flat two-dimensional photo to uh see

748

00:27:14,310 --> 00:27:11,600

sort of

749

00:27:15,590 --> 00:27:14,320

what kind of specularly or shininess

750

00:27:17,110 --> 00:27:15,600

essentially

751

00:27:34,789 --> 00:27:17,120

the rocks are exhibiting which is a very

752

00:27:39,190 --> 00:27:36,789

a couple of images yeah of the kinds of

753

00:27:41,590 --> 00:27:39,200

data that i work with so

754

00:27:43,990 --> 00:27:41,600

i have here a 3d image of mars taken by

755

00:27:47,269 --> 00:27:44,000

curiosity yeah so this is another

756

00:27:49,510 --> 00:27:47,279

stereoscopic image oh if i put on my 3d

757

00:27:51,830 --> 00:27:49,520

glasses yeah if you put on your 3d

758

00:27:53,430 --> 00:27:51,840

glasses you can see it in 3d if any of

759

00:27:55,029 --> 00:27:53,440

you at home casually have some of these

760

00:27:55,990 --> 00:27:55,039

lying around

761

00:27:57,750 --> 00:27:56,000

yeah

762

00:27:58,789 --> 00:27:57,760

from from your favorite 90s movies as a

763

00:28:02,149 --> 00:27:58,799

kid

764

00:28:05,669 --> 00:28:02,159

um yes so this is mount sharp uh scene

765

00:28:09,029 --> 00:28:05,679

through curiosity's uh navigation camera

766

00:28:10,789 --> 00:28:09,039

um with just this 3d

767

00:28:12,549 --> 00:28:10,799

layer of rocks in front of it that you

768

00:28:14,549 --> 00:28:12,559

can see kind of coming out of the screen

769

00:28:16,549 --> 00:28:14,559

here if you look at it right you really

770

00:28:18,630 --> 00:28:16,559

are yeah

771

00:28:21,029 --> 00:28:18,640

so it it really shows you how different

772

00:28:22,630 --> 00:28:21,039

it is observing in 3d versus 2d right

773

00:28:23,750 --> 00:28:22,640

right all the difference that could make

774

00:28:29,430 --> 00:28:23,760

yeah

775

00:28:32,389 --> 00:28:29,440

is there another one uh there is another

776

00:28:35,510 --> 00:28:32,399

one 3d image of mars taken from orbit i

777

00:28:37,909 --> 00:28:35,520

see yes so um

778

00:28:39,510 --> 00:28:37,919

comes up yep this is uh mouth vellus a

779

00:28:41,669 --> 00:28:39,520

nice welsh name

780

00:28:44,149 --> 00:28:41,679

um which is one of the oldest valleys on

781

00:28:45,830 --> 00:28:44,159

mars and this was taken from orbit i

782

00:28:48,310 --> 00:28:45,840

believe because they were scouting it as

783

00:28:51,110 --> 00:28:48,320

a possible landing site oh cool and it

784

00:28:52,870 --> 00:28:51,120

also shows that really intense uh sort

785

00:28:54,549 --> 00:28:52,880

of jaggedness of the rocks when you look

786

00:28:57,029 --> 00:28:54,559

at it in 3d definitely tell the

787

00:28:58,870 --> 00:28:57,039

difference yeah and these these images

788

00:29:00,870 --> 00:28:58,880

are available on nasa's website if any

789

00:29:02,470 --> 00:29:00,880

of you at home want to nip out and get

790

00:29:03,750 --> 00:29:02,480

yourself some of these for later that's

791

00:29:05,110 --> 00:29:03,760

right

792

00:29:06,870 --> 00:29:05,120

i'm just going to wear these for the

793

00:29:09,029 --> 00:29:06,880

rest of the show i think

794

00:29:09,909 --> 00:29:09,039

they're a good look they're high fashion

795

00:29:11,510 --> 00:29:09,919

yeah

796

00:29:13,750 --> 00:29:11,520

and very cheap so great for making your

797

00:29:15,350 --> 00:29:13,760

own costume at home that's right

798

00:29:17,750 --> 00:29:15,360

you can easily recreate lindley's

799

00:29:18,950 --> 00:29:17,760

customers yes yeah close your shoes tie

800

00:29:21,110 --> 00:29:18,960

up your hair and get yourself a pair of

801

00:29:23,029 --> 00:29:21,120

3d glasses that's right

802

00:29:24,470 --> 00:29:23,039

how long have you been an intern here um

803

00:29:26,149 --> 00:29:24,480

so i've been an intern here for eight

804

00:29:28,710 --> 00:29:26,159

and a half weeks and i'm here for

805

00:29:30,950 --> 00:29:28,720

another seven and a half so standard 16

806

00:29:33,669 --> 00:29:30,960

week autumn internship yeah but you guys

807

00:29:35,830 --> 00:29:33,679

get to work and you do so seriously yeah

808

00:29:36,710 --> 00:29:35,840

yeah they sort of you get it described

809

00:29:38,470 --> 00:29:36,720

to you as you're just going to hit the

810

00:29:39,990 --> 00:29:38,480

ground running and just keep going and

811

00:29:43,029 --> 00:29:40,000

then eventually you'll get to leave but

812

00:29:48,789 --> 00:29:45,350

awesome we have questions and comments

813

00:29:50,950 --> 00:29:48,799

oh yeah yeah we have uh biff who is

814

00:29:52,389 --> 00:29:50,960

asking what kind of cad software do you

815

00:29:54,950 --> 00:29:52,399

use if any

816

00:29:58,070 --> 00:29:54,960

um so we actually work with a variety of

817

00:30:00,149 --> 00:29:58,080

things so we don't do um

818

00:30:01,590 --> 00:30:00,159

like geometric cad style stuff because

819

00:30:03,430 --> 00:30:01,600

what we're working with is very organic

820

00:30:06,549 --> 00:30:03,440

forms we're working with meshes and so

821

00:30:09,029 --> 00:30:06,559

you can use tools like um mesh mixer

822

00:30:11,350 --> 00:30:09,039

what i use actually varies depending on

823

00:30:12,789 --> 00:30:11,360

what i'm working with in that moment so

824

00:30:15,190 --> 00:30:12,799

there's certain programs that you need

825

00:30:17,990 --> 00:30:15,200

to make stls for 3d printing

826

00:30:19,669 --> 00:30:18,000

um we use a prusa printer

827

00:30:22,950 --> 00:30:19,679

but there are different types

828

00:30:24,950 --> 00:30:22,960

and i also use um mesh mixer combined

829

00:30:26,389 --> 00:30:24,960

with unity for some of my augmented

830

00:30:28,230 --> 00:30:26,399

reality stuff so there's lots of

831

00:30:30,789 --> 00:30:28,240

different programs that you need to

832

00:30:33,029 --> 00:30:30,799

combine to be able to do things

833

00:30:34,830 --> 00:30:33,039

related stealthysumo asks what kind of

834

00:30:37,669 --> 00:30:34,840

3d printing

835

00:30:40,510 --> 00:30:37,679

stereolithography uh yes so this is uh

836

00:30:42,230 --> 00:30:40,520

fused deposition modeling um it's not

837

00:30:44,149 --> 00:30:42,240

stereography but you can use

838

00:30:47,269 --> 00:30:44,159

stereolithography to achieve a similar

839

00:30:49,590 --> 00:30:47,279

effect um but the texture would come off

840

00:30:50,389 --> 00:30:49,600

sort of almost inverted

841

00:30:53,110 --> 00:30:50,399

okay

842

00:30:54,789 --> 00:30:53,120

i don't know this word but i'm assuming

843

00:30:56,310 --> 00:30:54,799

the people asking questions especially

844

00:30:57,990 --> 00:30:56,320

if you uh

845

00:30:59,430 --> 00:30:58,000

carve chunks out of a surface so that

846

00:31:01,350 --> 00:30:59,440

when you hold it up to the light you can

847

00:31:02,549 --> 00:31:01,360

look through it and you can see a 3d

848

00:31:03,990 --> 00:31:02,559

image

849

00:31:05,990 --> 00:31:04,000

so you're essentially making parts of it

850

00:31:09,750 --> 00:31:06,000

translucent to look through yeah all

851

00:31:13,110 --> 00:31:09,760

right a while ago rj the noob declared

852

00:31:14,789 --> 00:31:13,120

that's awesome i don't know exactly

853

00:31:16,470 --> 00:31:14,799

the whole thing is awesome being a nasa

854

00:31:19,430 --> 00:31:16,480

intern doing stuff to do with my

855

00:31:20,710 --> 00:31:19,440

research is all awesome

856

00:31:22,470 --> 00:31:20,720

a few more

857

00:31:25,430 --> 00:31:22,480

i could say yeah how do we get that

858

00:31:26,389 --> 00:31:25,440

awesome accent for our costume

859

00:31:27,750 --> 00:31:26,399

why don't you tell everybody where

860

00:31:29,830 --> 00:31:27,760

you're from and how you ended up here

861

00:31:31,830 --> 00:31:29,840

yeah so i'm from new zealand and i ended

862

00:31:33,190 --> 00:31:31,840

up here on a partnership with um the new

863

00:31:34,710 --> 00:31:33,200

zealand government the ministry of

864

00:31:37,110 --> 00:31:34,720

business innovation and employment in

865

00:31:39,190 --> 00:31:37,120

particular the new zealand space uh

866

00:31:42,950 --> 00:31:39,200

administration not an administration

867

00:31:43,909 --> 00:31:42,960

agency i got it confused with nasa

868

00:31:45,430 --> 00:31:43,919

yes

869

00:31:47,909 --> 00:31:45,440

understandable

870

00:31:48,870 --> 00:31:47,919

versus nasa they're very similar

871

00:31:50,870 --> 00:31:48,880

um

872

00:31:53,509 --> 00:31:50,880

yeah so uh hang out in new zealand for a

873

00:31:55,669 --> 00:31:53,519

while really relax your vocal cords lean

874

00:31:58,630 --> 00:31:55,679

into it um it helps to be a bit maori as

875

00:31:59,990 --> 00:31:58,640

well uh take items the really key thing

876

00:32:01,990 --> 00:32:00,000

if you want to be an international

877

00:32:04,789 --> 00:32:02,000

intern is really bring parts of home

878

00:32:06,470 --> 00:32:04,799

with you yeah yeah yeah you're speaking

879

00:32:09,430 --> 00:32:06,480

to someone out there wordsworth says

880

00:32:12,549 --> 00:32:09,440

nice to hear a new zealand accent yes

881

00:32:17,269 --> 00:32:15,110

all right we'll have to move on soon but

882

00:32:18,789 --> 00:32:17,279

we have a couple more um

883

00:32:21,430 --> 00:32:18,799

if you know this

884

00:32:23,190 --> 00:32:21,440

gayeskimo asks what clay types are the

885

00:32:25,269 --> 00:32:23,200

most common on mars

886

00:32:28,230 --> 00:32:25,279

do you know i don't know off the top of

887

00:32:30,549 --> 00:32:28,240

my head um that is probably something

888

00:32:32,310 --> 00:32:30,559

that that uh yeah

889

00:32:33,669 --> 00:32:32,320

more geologists would know

890

00:32:35,350 --> 00:32:33,679

part of what we're hoping to do in

891

00:32:37,029 --> 00:32:35,360

future with this is partnering with

892

00:32:38,870 --> 00:32:37,039

geologists to find out what is key to

893

00:32:40,070 --> 00:32:38,880

them with their work but one of the

894

00:32:42,310 --> 00:32:40,080

things that you face when you're

895

00:32:43,909 --> 00:32:42,320

designing for scientists is uh kind of

896

00:32:45,830 --> 00:32:43,919

what's called like the you know it when

897

00:32:48,789 --> 00:32:45,840

you see it problem it's very difficult

898

00:32:50,230 --> 00:32:48,799

to quantify what you're looking at until

899

00:32:52,149 --> 00:32:50,240

you can actually show it to somebody and

900

00:32:54,470 --> 00:32:52,159

be like is this what you wanted and they

901  
00:32:56,230 --> 00:32:54,480  
can be like kindness

902  
00:32:58,389 --> 00:32:56,240  
and then you go back and you refine it

903  
00:33:00,310 --> 00:32:58,399  
and you you keep updating your designs

904  
00:33:02,389 --> 00:33:00,320  
excellent all right

905  
00:33:03,830 --> 00:33:02,399  
touching zombies says she uses

906  
00:33:05,430 --> 00:33:03,840  
intelligence

907  
00:33:07,590 --> 00:33:05,440  
i would agree

908  
00:33:09,669 --> 00:33:07,600  
and last question before we have to let

909  
00:33:12,230 --> 00:33:09,679  
you go rj the new best so how many

910  
00:33:13,909 --> 00:33:12,240  
different angled images of that drill

911  
00:33:16,149 --> 00:33:13,919  
site do you need to be able to make an

912  
00:33:19,750 --> 00:33:16,159  
accurate 3d model i believe

913  
00:33:21,830 --> 00:33:19,760

that this was just made from two um but

914

00:33:23,750 --> 00:33:21,840

there's a uh

915

00:33:26,149 --> 00:33:23,760

method of creating images that involves

916

00:33:28,789 --> 00:33:26,159

taking entire images that are rotated

917

00:33:31,190 --> 00:33:28,799

around a single rock and um thinking of

918

00:33:32,950 --> 00:33:31,200

ways to get cameras like that to remote

919

00:33:35,590 --> 00:33:32,960

places is one of the big challenges that

920

00:33:38,230 --> 00:33:35,600

the intelligent robotics group faces

921

00:33:40,870 --> 00:33:38,240

i guess so just before i go can i plug

922

00:33:43,350 --> 00:33:40,880

that you know um if you two want to be

923

00:33:46,310 --> 00:33:43,360

an intern here um the website for that

924

00:33:48,389 --> 00:33:46,320

is intern.nasa.gov if you are a domestic

925

00:33:50,950 --> 00:33:48,399

intern right um which is somebody from

926  
00:33:52,950 --> 00:33:50,960  
the us and if you go there and you are

927  
00:33:54,549 --> 00:33:52,960  
an international student who's

928  
00:33:58,230 --> 00:33:54,559  
interested in becoming an intern if you

929  
00:34:00,549 --> 00:33:58,240  
go to the uh section on um requirements

930  
00:34:02,230 --> 00:34:00,559  
there's a link to the page for um

931  
00:34:05,350 --> 00:34:02,240  
international interns which has an

932  
00:34:06,789 --> 00:34:05,360  
incredibly long url that i've oh

933  
00:34:08,389 --> 00:34:06,799  
which is why you have to do it that way

934  
00:34:10,950 --> 00:34:08,399  
that's fine yeah we know how to get

935  
00:34:12,950 --> 00:34:10,960  
there now all right excellent tip very

936  
00:34:15,430 --> 00:34:12,960  
good thank you for that thank you thank

937  
00:34:16,950 --> 00:34:15,440  
you for sharing your work yes uh i think

938  
00:34:18,869 --> 00:34:16,960

we know how to recreate your look we're

939

00:34:33,030 --> 00:34:18,879

gonna tie your hair back closed shoes

940

00:34:37,349 --> 00:34:35,829

voting yeah thanks for joining us

941

00:34:38,669 --> 00:34:37,359

all right

942

00:34:41,270 --> 00:34:38,679

so yes

943

00:34:44,389 --> 00:34:41,280

intern.nasa.gov is where you want to be

944

00:34:46,790 --> 00:34:44,399

and we did a whole episode about how to

945

00:34:48,950 --> 00:34:46,800

become an intern and we met some interns

946

00:34:51,349 --> 00:34:48,960

and some full-time employees who were

947

00:34:52,869 --> 00:34:51,359

once interns so there's lots of info on

948

00:34:54,629 --> 00:34:52,879

that episode if you want to look that up

949

00:34:57,030 --> 00:34:54,639

interns are always fun all right well

950

00:34:59,589 --> 00:34:57,040

let's keep the party going let's bring

951  
00:35:04,870 --> 00:34:59,599  
out our next two guests come on out

952  
00:35:04,880 --> 00:35:09,910  
oh wow what

953  
00:35:15,829 --> 00:35:12,470  
is this

954  
00:35:19,270 --> 00:35:15,839  
i have not seen these before fantastic

955  
00:35:24,230 --> 00:35:21,670  
it's a little warm in there but

956  
00:35:26,550 --> 00:35:24,240  
pull up a chair

957  
00:35:28,790 --> 00:35:26,560  
join the party yes happy to have you

958  
00:35:32,840 --> 00:35:28,800  
thank you

959  
00:35:32,850 --> 00:35:37,990  
[Laughter]

960  
00:35:42,550 --> 00:35:39,910  
so tell us your name and what you do

961  
00:35:44,790 --> 00:35:42,560  
here yes my name is nettie rusboom i am

962  
00:35:46,390 --> 00:35:44,800  
an aerospace engineer here

963  
00:35:48,150 --> 00:35:46,400

and i'm jennifer bernie and i'm also an

964

00:35:49,589 --> 00:35:48,160

aerospace engineer and netti and i both

965

00:35:51,750 --> 00:35:49,599

work in the unitary plan wind tunnel

966

00:35:53,750 --> 00:35:51,760

here at ames the wind tunnel

967

00:35:55,670 --> 00:35:53,760

yeah all right tell us first about what

968

00:35:57,670 --> 00:35:55,680

you're wearing and then so nothing i

969

00:35:59,589 --> 00:35:57,680

both have on coveralls um there's

970

00:36:01,109 --> 00:35:59,599

nothing really to the colors just two

971

00:36:03,109 --> 00:36:01,119

really nice signs and we also had two

972

00:36:04,710 --> 00:36:03,119

different kinds of respirators on the

973

00:36:06,310 --> 00:36:04,720

important part is to protect our lungs

974

00:36:08,470 --> 00:36:06,320

and eyes from the paint that we're using

975

00:36:10,310 --> 00:36:08,480

okay we also are having some uv glasses

976  
00:36:12,470 --> 00:36:10,320  
because we also use uv lights

977  
00:36:13,349 --> 00:36:12,480  
gonna have to hear all about

978  
00:36:15,109 --> 00:36:13,359  
can i

979  
00:36:16,870 --> 00:36:15,119  
bring up your respirator yeah just to

980  
00:36:19,829 --> 00:36:16,880  
get a look wow that's this is a full

981  
00:36:21,670 --> 00:36:19,839  
face respirator that's serious yeah okay

982  
00:36:24,310 --> 00:36:21,680  
so this is to protect you while you are

983  
00:36:26,630 --> 00:36:24,320  
painting yes what are you painting

984  
00:36:28,870 --> 00:36:26,640  
aerospace engineers that's not expected

985  
00:36:30,470 --> 00:36:28,880  
right no it's not normally aerodynamic

986  
00:36:34,470 --> 00:36:30,480  
models but specifically i think we have

987  
00:36:35,349 --> 00:36:34,480  
photos of we are painting rockets

988  
00:36:53,109 --> 00:36:35,359

cool

989

00:36:56,950 --> 00:36:54,950

scaled models we put them in these

990

00:36:58,390 --> 00:36:56,960

facilities where the air moves over them

991

00:37:01,589 --> 00:36:58,400

if we could we would launch these

992

00:37:03,990 --> 00:37:01,599

rockets or aircraft everything um all

993

00:37:04,950 --> 00:37:04,000

the time but first we have to

994

00:37:06,310 --> 00:37:04,960

um

995

00:37:07,670 --> 00:37:06,320

first we have to model them and we put

996

00:37:09,589 --> 00:37:07,680

them in a controlled environment like

997

00:37:11,109 --> 00:37:09,599

the wind tunnel and we blow air over

998

00:37:13,430 --> 00:37:11,119

them and we measure the pressure

999

00:37:14,950 --> 00:37:13,440

distribution across the model that's at

1000

00:37:16,870 --> 00:37:14,960

the heart of what we're wanting to do

1001  
00:37:19,030 --> 00:37:16,880  
most wind tunnel tests okay right before

1002  
00:37:20,390 --> 00:37:19,040  
anybody builds it and tries to fly it

1003  
00:37:22,150 --> 00:37:20,400  
you're going to test it all out on a

1004  
00:37:24,310 --> 00:37:22,160  
little model yes we need to understand

1005  
00:37:25,829 --> 00:37:24,320  
it better and yes

1006  
00:37:27,670 --> 00:37:25,839  
the model yes

1007  
00:37:29,670 --> 00:37:27,680  
understanding how it acts under these

1008  
00:37:31,349 --> 00:37:29,680  
controlled environments

1009  
00:37:32,870 --> 00:37:31,359  
yeah we have several wind tunnels here

1010  
00:37:39,349 --> 00:37:32,880  
right and when we have the biggest in

1011  
00:37:44,230 --> 00:37:41,030  
but also the one that we work at it was

1012  
00:37:46,230 --> 00:37:44,240  
built in the 1950s before even nasa was

1013  
00:37:48,470 --> 00:37:46,240

nasa it was under the naca so it has a

1014

00:37:51,829 --> 00:37:48,480

very rich history of uh you know the

1015

00:37:54,390 --> 00:37:51,839

aircraft that our predecessor the naca

1016

00:37:55,990 --> 00:37:54,400

was responsible for and then all of the

1017

00:37:58,870 --> 00:37:56,000

the space missions that have had launch

1018

00:38:00,790 --> 00:37:58,880

vehicles and of course crude missions uh

1019

00:38:02,950 --> 00:38:00,800

have been tested here yeah awesome what

1020

00:38:04,550 --> 00:38:02,960

a historic place so cool okay so you

1021

00:38:05,670 --> 00:38:04,560

guys are in there

1022

00:38:06,950 --> 00:38:05,680

painting

1023

00:38:09,109 --> 00:38:06,960

tell us about the paint because that

1024

00:38:10,710 --> 00:38:09,119

makes no sense to anybody

1025

00:38:12,630 --> 00:38:10,720

so we use a special kind of paint called

1026

00:38:14,150 --> 00:38:12,640

pressure sensitive paint it is a

1027

00:38:15,670 --> 00:38:14,160

characteristic pink color because of the

1028

00:38:17,270 --> 00:38:15,680

chemicals in the paint oh really but

1029

00:38:19,589 --> 00:38:17,280

what makes it really special is when you

1030

00:38:22,310 --> 00:38:19,599

expose it to uv light it emits or

1031

00:38:24,310 --> 00:38:22,320

fluoresces its own light as well yeah

1032

00:38:26,950 --> 00:38:24,320

yeah yeah it goes we have a picture of

1033

00:38:29,910 --> 00:38:26,960

this of one of the rocket models painted

1034

00:38:32,230 --> 00:38:29,920

yeah yeah yeah that's our

1035

00:38:34,230 --> 00:38:32,240

nasa power of pink

1036

00:38:36,630 --> 00:38:34,240

uh yes there's a you know as you can see

1037

00:38:39,109 --> 00:38:36,640

in the photo the the model to our eyes

1038

00:38:40,470 --> 00:38:39,119

is pink um you see that also the blue

1039

00:38:42,150 --> 00:38:40,480

light that's coming around and that's

1040

00:38:45,030 --> 00:38:42,160

what jenny highlighted is that we have

1041

00:38:47,510 --> 00:38:45,040

these uv lights uh look kind of blue or

1042

00:38:49,589 --> 00:38:47,520

purplish that's me there in the test

1043

00:38:52,310 --> 00:38:49,599

section so as you can tell this is a

1044

00:38:54,550 --> 00:38:52,320

scaled model of a rocket this is the

1045

00:38:55,750 --> 00:38:54,560

rocket that is project artemis this is

1046

00:38:58,390 --> 00:38:55,760

going to take the first woman and the

1047

00:38:59,829 --> 00:38:58,400

next man to the moon and on on that

1048

00:39:02,550 --> 00:38:59,839

picture and there's a place where the

1049

00:39:05,750 --> 00:39:02,560

crew will sit and so understanding how

1050

00:39:07,750 --> 00:39:05,760

that model um is designed and how it

1051

00:39:09,270 --> 00:39:07,760

will be controlled when it uh is

1052

00:39:10,150 --> 00:39:09,280

launched is very important so that's why

1053

00:39:12,390 --> 00:39:10,160

we do

1054

00:39:13,589 --> 00:39:12,400

extensive studies extensive tests and

1055

00:39:15,670 --> 00:39:13,599

and now with the pressure sensitive

1056

00:39:18,310 --> 00:39:15,680

paint uh you know we're sensing that

1057

00:39:20,390 --> 00:39:18,320

pressure over the whole vehicle which is

1058

00:39:22,710 --> 00:39:20,400

that's that's the new state of the art

1059

00:39:24,790 --> 00:39:22,720

on um what we're applying to wind tunnel

1060

00:39:26,790 --> 00:39:24,800

testing oh yeah how long does it take

1061

00:39:28,630 --> 00:39:26,800

you to paint the model

1062

00:39:30,230 --> 00:39:28,640

usually a couple hours we use these

1063

00:39:31,030 --> 00:39:30,240

spray guns and eddie has modeled over

1064

00:39:33,910 --> 00:39:31,040

here

1065

00:39:35,670 --> 00:39:33,920

and we apply a primer a base coat that's

1066

00:39:36,710 --> 00:39:35,680

white and then a red top coat that's

1067

00:39:38,790 --> 00:39:36,720

very light which is why it gets that

1068

00:39:40,630 --> 00:39:38,800

nice pink color

1069

00:39:44,310 --> 00:39:40,640

awesome i have some comments here

1070

00:39:46,230 --> 00:39:44,320

verified amy i'm in awe of all of you

1071

00:39:47,030 --> 00:39:46,240

[Laughter]

1072

00:39:49,190 --> 00:39:47,040

oh

1073

00:39:51,190 --> 00:39:49,200

relevant rj the noob have you tested any

1074

00:39:53,510 --> 00:39:51,200

models for the future artemis missions

1075

00:39:55,270 --> 00:39:53,520

yeah you're just saying that right

1076

00:39:58,069 --> 00:39:55,280

yeah that's what we're doing right now

1077

00:40:00,790 --> 00:39:58,079

is testing both uh for the crude artemis

1078

00:40:02,710 --> 00:40:00,800

missions but also the cargo to the uh uh

1079

00:40:04,069 --> 00:40:02,720

maybe a few images that you'll see on

1080

00:40:06,069 --> 00:40:04,079

the internet there are very different

1081

00:40:08,390 --> 00:40:06,079

vehicles that you use to move people uh

1082

00:40:09,990 --> 00:40:08,400

because that has a much higher level of

1083

00:40:11,829 --> 00:40:10,000

safety

1084

00:40:13,910 --> 00:40:11,839

to keep people safe but then we also

1085

00:40:15,030 --> 00:40:13,920

move you know satellites we move we're

1086

00:40:19,030 --> 00:40:15,040

going to move

1087

00:40:21,030 --> 00:40:19,040

we're going to um

1088

00:40:22,870 --> 00:40:21,040

yeah a lot of cargo so there's different

1089

00:40:25,190 --> 00:40:22,880

uh rocket

1090

00:40:27,430 --> 00:40:25,200

nose pairing shapes that we test and and

1091

00:40:29,589 --> 00:40:27,440

we actually did one very recently yes

1092

00:40:31,750 --> 00:40:29,599

yes and so that that's the rocket you're

1093

00:40:34,710 --> 00:40:31,760

talking about right which is called yes

1094

00:40:36,790 --> 00:40:34,720

this is this one is uh sm-1 uh space

1095

00:40:38,309 --> 00:40:36,800

mission one but this is yeah also part

1096

00:40:40,870 --> 00:40:38,319

of artemis right and the rocket is the

1097

00:40:42,790 --> 00:40:40,880

space launch system right and we have

1098

00:40:45,190 --> 00:40:42,800

time lapse so you guys meet again yeah

1099

00:40:47,109 --> 00:40:45,200

let's see that and you can tell us

1100

00:40:50,150 --> 00:40:47,119

to show this yeah so as you can see

1101  
00:40:53,109 --> 00:40:50,160  
that's our respirators on there um and

1102  
00:40:54,309 --> 00:40:53,119  
we're moving around the tunnel uh the

1103  
00:40:55,589 --> 00:40:54,319  
there's

1104  
00:40:57,349 --> 00:40:55,599  
you know small

1105  
00:40:59,829 --> 00:40:57,359  
cylindrical sections that you see there

1106  
00:41:01,430 --> 00:40:59,839  
at the left is are the boosters that uh

1107  
00:41:03,270 --> 00:41:01,440  
you know when this is uh you see

1108  
00:41:05,510 --> 00:41:03,280  
animations you see two boosters in this

1109  
00:41:07,670 --> 00:41:05,520  
core and this is gonna lift off up into

1110  
00:41:09,109 --> 00:41:07,680  
space so uh we take those off just for

1111  
00:41:12,710 --> 00:41:09,119  
painting and then we'll put them back on

1112  
00:41:14,230 --> 00:41:12,720  
but yeah a lot of work goes into that uh

1113  
00:41:16,230 --> 00:41:14,240

you know getting a wind tunnel model

1114

00:41:18,390 --> 00:41:16,240

even just to that point and so i think

1115

00:41:19,670 --> 00:41:18,400

it's really tested yeah yeah yeah and

1116

00:41:21,430 --> 00:41:19,680

it's beautiful because it gives you a

1117

00:41:23,190 --> 00:41:21,440

really big appreciation for you know

1118

00:41:25,349 --> 00:41:23,200

when that model is on the launch pad

1119

00:41:27,109 --> 00:41:25,359

just knowing how many people had a

1120

00:41:28,630 --> 00:41:27,119

fingerprint on that model and who all

1121

00:41:32,069 --> 00:41:28,640

was involved and all the facilities of

1122

00:41:33,910 --> 00:41:32,079

nasa and you know what what rich

1123

00:41:36,230 --> 00:41:33,920

facilities technology and people that we

1124

00:41:38,790 --> 00:41:36,240

have yeah awesome

1125

00:41:40,790 --> 00:41:38,800

uh we have some more questions some to

1126  
00:41:42,710 --> 00:41:40,800  
review and clarify wordsworth asks what

1127  
00:42:00,230 --> 00:41:42,720  
makes it pink

1128  
00:42:04,790 --> 00:42:02,150  
special about the paint to keep dust and

1129  
00:42:07,349 --> 00:42:04,800  
condensation from accumulating on it

1130  
00:42:09,990 --> 00:42:07,359  
while in space so let's clarify do you

1131  
00:42:11,589 --> 00:42:10,000  
use the paint only for testing here yes

1132  
00:42:12,950 --> 00:42:11,599  
okay it's very particular it's just to

1133  
00:42:15,190 --> 00:42:12,960  
help us see how pressures are

1134  
00:42:17,109 --> 00:42:15,200  
distributed on the model the actual

1135  
00:42:19,190 --> 00:42:17,119  
rocket will be painted with real paints

1136  
00:42:21,030 --> 00:42:19,200  
okay not this special paint yeah yeah

1137  
00:42:23,030 --> 00:42:21,040  
yeah this is like high-tech it's a tool

1138  
00:42:24,710 --> 00:42:23,040

right it's a pressure sensor basically

1139

00:42:26,309 --> 00:42:24,720

it is a pressure sensor and yeah so

1140

00:42:28,309 --> 00:42:26,319

traditionally we've had these uh

1141

00:42:30,390 --> 00:42:28,319

pressure sensors that are on the model

1142

00:42:33,270 --> 00:42:30,400

on the model and yeah they're they're

1143

00:42:34,790 --> 00:42:33,280

fairly fine but uh in respect to the

1144

00:42:35,990 --> 00:42:34,800

area of the model they're really coarse

1145

00:42:37,750 --> 00:42:36,000

and they're only in these discrete

1146

00:42:39,430 --> 00:42:37,760

locations so we know the pressure really

1147

00:42:40,630 --> 00:42:39,440

well there yeah but like i said at the

1148

00:42:41,670 --> 00:42:40,640

heart of a wind tunnel test you want to

1149

00:42:43,829 --> 00:42:41,680

know the pressure

1150

00:42:45,910 --> 00:42:43,839

distribution everywhere on the model so

1151

00:42:47,030 --> 00:42:45,920

yeah that's what the the pain is

1152

00:42:48,550 --> 00:42:47,040

offering and that's really where the

1153

00:42:50,390 --> 00:42:48,560

state of the art is moving it's like how

1154

00:42:51,670 --> 00:42:50,400

do we know the pressure across the whole

1155

00:42:53,750 --> 00:42:51,680

vehicle

1156

00:42:55,510 --> 00:42:53,760

in between those sensors right yeah you

1157

00:42:57,430 --> 00:42:55,520

can't yeah the pain is what helps you

1158

00:42:58,950 --> 00:42:57,440

figure out what's in between yeah

1159

00:43:00,150 --> 00:42:58,960

because the sensors are so expensive and

1160

00:43:01,829 --> 00:43:00,160

you can't put them everywhere there's

1161

00:43:03,270 --> 00:43:01,839

not enough room in certain models so

1162

00:43:05,750 --> 00:43:03,280

you'll use this paint to kind of fill in

1163

00:43:07,589 --> 00:43:05,760

those gaps yeah yeah yeah it makes sense

1164

00:43:11,030 --> 00:43:07,599

yeah um

1165

00:43:12,470 --> 00:43:11,040

sinful 7 cg these painted models that

1166

00:43:14,470 --> 00:43:12,480

you're testing for the mission are they

1167

00:43:16,550 --> 00:43:14,480

simulated in areas other than the wind

1168

00:43:18,309 --> 00:43:16,560

tunnels

1169

00:43:21,270 --> 00:43:18,319

painted models no i would say it's

1170

00:43:22,790 --> 00:43:21,280

mostly uh wind tunnel technology um you

1171

00:43:26,230 --> 00:43:22,800

know it certainly could work here on the

1172

00:43:28,230 --> 00:43:26,240

bench top but uh yeah it's i would say

1173

00:43:30,230 --> 00:43:28,240

the main application is in a wind tunnel

1174

00:43:32,230 --> 00:43:30,240

and um of course we

1175

00:43:33,829 --> 00:43:32,240

uh we apply

1176  
00:43:36,630 --> 00:43:33,839  
as much hardware as we can so we have

1177  
00:43:38,150 --> 00:43:36,640  
multiple high-speed cameras we will we

1178  
00:43:39,829 --> 00:43:38,160  
mount four we will start mounting eight

1179  
00:43:41,589 --> 00:43:39,839  
high-speed cameras around them

1180  
00:43:44,069 --> 00:43:41,599  
that's that's what we're capturing so

1181  
00:43:45,829 --> 00:43:44,079  
the the paint uh responds

1182  
00:43:47,670 --> 00:43:45,839  
to pressure so it's either brighter or

1183  
00:43:50,069 --> 00:43:47,680  
dimmer depending on the oxygen uh which

1184  
00:43:52,309 --> 00:43:50,079  
is the pressure and and we record that

1185  
00:43:55,349 --> 00:43:52,319  
with yes from the wind tunnel when it's

1186  
00:43:57,510 --> 00:43:55,359  
on uh the pressure over the vehicle and

1187  
00:43:59,190 --> 00:43:57,520  
its magnitude is changing as we change

1188  
00:44:00,870 --> 00:43:59,200

conditions and so we take

1189

00:44:02,309 --> 00:44:00,880

lots of images and and then we take

1190

00:44:04,550 --> 00:44:02,319

those images and do a lot of image

1191

00:44:06,150 --> 00:44:04,560

processing to say this is uh you know

1192

00:44:07,030 --> 00:44:06,160

these main data products that you want

1193

00:44:09,349 --> 00:44:07,040

to know

1194

00:44:11,750 --> 00:44:09,359

from the from the wind tunnel test right

1195

00:44:13,670 --> 00:44:11,760

right all the data that the designers

1196

00:44:15,589 --> 00:44:13,680

yes we need to know do we need to adjust

1197

00:44:16,790 --> 00:44:15,599

this or is this good yeah that's kind of

1198

00:44:20,829 --> 00:44:16,800

yes yeah

1199

00:44:27,670 --> 00:44:24,950

right so how can we become aerospace

1200

00:44:29,750 --> 00:44:27,680

engineers for halloween

1201

00:44:31,750 --> 00:44:29,760

doing pressure sensitive paint testing

1202

00:44:32,710 --> 00:44:31,760

how can we recreate your look uh so much

1203

00:44:34,150 --> 00:44:32,720

like everyone else we're pretty

1204

00:44:35,829 --> 00:44:34,160

industrial you probably want to go to a

1205

00:44:37,349 --> 00:44:35,839

hardware store get some coveralls or a

1206

00:44:39,030 --> 00:44:37,359

paint store get something that looks

1207

00:44:40,870 --> 00:44:39,040

like a respirator something to protect

1208

00:44:42,870 --> 00:44:40,880

your eyes that's right yeah yeah yeah

1209

00:44:44,870 --> 00:44:42,880

don't forget the rest yeah

1210

00:44:46,630 --> 00:44:44,880

yeah you could channel your inner rosie

1211

00:44:48,630 --> 00:44:46,640

the riveter

1212

00:44:50,470 --> 00:44:48,640

halloween and just know that you're here

1213

00:44:53,990 --> 00:44:50,480

with us painting wind tunnel models

1214

00:44:56,390 --> 00:44:54,000

making a difference fantastic nice

1215

00:44:57,670 --> 00:44:56,400

all right well you guys can head

1216

00:44:59,270 --> 00:44:57,680

backstage and then we're going to bring

1217

00:45:01,190 --> 00:44:59,280

you all back out in a minute because

1218

00:45:05,990 --> 00:45:01,200

it's time to vote all right thank you

1219

00:45:09,910 --> 00:45:07,990

they're the coolest

1220

00:45:11,910 --> 00:45:09,920

all these jobs that i didn't even know

1221

00:45:14,150 --> 00:45:11,920

knew i didn't know before exists right

1222

00:45:16,550 --> 00:45:14,160

at nasa and really exactly what they do

1223

00:45:18,390 --> 00:45:16,560

for missions right totally cool you know

1224

00:45:19,750 --> 00:45:18,400

painting a model

1225

00:45:22,230 --> 00:45:19,760

you know figuring out how you can like

1226  
00:45:24,550 --> 00:45:22,240  
help to re-engineer if needed yep yep

1227  
00:45:26,870 --> 00:45:24,560  
the big the biggest rocket will have

1228  
00:45:28,790 --> 00:45:26,880  
right exactly that's what their work

1229  
00:45:32,390 --> 00:45:28,800  
leads into yeah it's awesome

1230  
00:45:34,470 --> 00:45:32,400  
but now you guys it is time to vote yes

1231  
00:45:36,630 --> 00:45:34,480  
so we're voting here for our favorite

1232  
00:45:38,870 --> 00:45:36,640  
costume in the everyday nasa looks

1233  
00:45:40,470 --> 00:45:38,880  
category so we're going to bring back

1234  
00:45:58,710 --> 00:45:40,480  
all of our guests and then you can vote

1235  
00:46:04,390 --> 00:46:01,349  
mechanical engineer chuck

1236  
00:46:08,309 --> 00:46:06,630  
excellent that's right

1237  
00:46:14,150 --> 00:46:08,319  
next we have

1238  
00:46:18,230 --> 00:46:15,750

glasses

1239

00:46:20,069 --> 00:46:18,240

3d printed pool

1240

00:46:24,309 --> 00:46:20,079

and lastly here's another look at

1241

00:46:27,109 --> 00:46:24,319

aerospace engineers nettie and jenny

1242

00:46:31,430 --> 00:46:29,109

look at that look

1243

00:46:34,470 --> 00:46:31,440

you gotta be afraid very nice all right

1244

00:46:35,829 --> 00:46:34,480

take your looks yeah get your votes in

1245

00:46:38,309 --> 00:46:35,839

it's your last looks in there they're

1246

00:46:39,670 --> 00:46:38,319

both coming in they're coming

1247

00:46:45,589 --> 00:46:39,680

i don't want to rush it i don't want to

1248

00:46:45,599 --> 00:46:49,910

you gotta show this is your last chance

1249

00:46:54,790 --> 00:46:53,190

oh true what do we get if we win

1250

00:46:58,470 --> 00:46:54,800

mary beth asks

1251  
00:47:00,390 --> 00:46:58,480  
our undying respect

1252  
00:47:03,030 --> 00:47:00,400  
yes okay

1253  
00:47:04,790 --> 00:47:03,040  
ready guys i have the winner

1254  
00:47:08,790 --> 00:47:04,800  
it goes to

1255  
00:47:13,270 --> 00:47:11,109  
our aerospace engineers

1256  
00:47:15,349 --> 00:47:13,280  
spray painting rocket models with

1257  
00:47:17,190 --> 00:47:15,359  
pressure sensitive paint yes in their

1258  
00:47:18,870 --> 00:47:17,200  
unitary wind tunnels

1259  
00:47:21,030 --> 00:47:18,880  
that's right all right but you're all

1260  
00:47:23,829 --> 00:47:21,040  
fabulous thank you for all the winners

1261  
00:47:25,589 --> 00:47:23,839  
today of course yes thanks for joining

1262  
00:47:30,790 --> 00:47:25,599  
us today we loved hearing about your

1263  
00:47:35,270 --> 00:47:32,549

fabulous

1264

00:47:37,829 --> 00:47:35,280

a quick reminder you guys that if you do

1265

00:47:40,230 --> 00:47:37,839

end up using any of these looks uh for

1266

00:47:42,390 --> 00:47:40,240

halloween we want to see them so you can

1267

00:47:44,470 --> 00:47:42,400

share your nasa inspired costumes with

1268

00:47:46,230 --> 00:47:44,480

us on social media using the hashtag

1269

00:47:48,549 --> 00:47:46,240

nasa costumes

1270

00:47:50,790 --> 00:47:48,559

yes exactly yeah i'm going to use that

1271

00:47:52,230 --> 00:47:50,800

now that i have all these costume ideas

1272

00:47:53,700 --> 00:47:52,240

i didn't have a costume as of this

1273

00:47:55,589 --> 00:47:53,710

morning but didn't either

1274

00:47:57,510 --> 00:47:55,599

[Applause]

1275

00:48:00,309 --> 00:47:57,520

so that was fabulous i'm so excited

1276  
00:48:02,870 --> 00:48:00,319  
about the everyday looks but now we're

1277  
00:48:05,510 --> 00:48:02,880  
going on to our second category which is

1278  
00:48:06,390 --> 00:48:05,520  
nasa inspired cosplay costumes my

1279  
00:48:08,790 --> 00:48:06,400  
favorite

1280  
00:48:10,470 --> 00:48:08,800  
do you love this this is so i love how

1281  
00:48:13,030 --> 00:48:10,480  
creative they get things you would never

1282  
00:48:15,349 --> 00:48:13,040  
imagine come out of these nasa themed

1283  
00:48:17,910 --> 00:48:15,359  
costumes yeah all right so cosplay

1284  
00:48:20,230 --> 00:48:17,920  
costumes with a nasa twist

1285  
00:48:23,349 --> 00:48:20,240  
let's bring out our first guest you want

1286  
00:48:25,190 --> 00:48:23,359  
to introduce yes so if you've watched

1287  
00:48:28,069 --> 00:48:25,200  
past episodes of the show you may

1288  
00:48:31,030 --> 00:48:28,079

recognize the sith lord from a galaxy

1289

00:48:32,230 --> 00:48:31,040

not so far far away and i hear that if

1290

00:48:34,790 --> 00:48:32,240

you truly

1291

00:48:36,470 --> 00:48:34,800

are one with the force she may even let

1292

00:48:39,190 --> 00:48:36,480

you pray through a telescope

1293

00:48:41,349 --> 00:48:39,200

come on out darth kimberly cosplaying as

1294

00:48:42,190 --> 00:48:41,359

astrophysicists

1295

00:48:43,990 --> 00:48:42,200

an

1296

00:48:45,349 --> 00:48:44,000

astrophysicist

1297

00:48:47,930 --> 00:48:45,359

you say

1298

00:48:57,670 --> 00:48:47,940

oh no now kimberly

1299

00:49:03,109 --> 00:49:00,069

oh my gosh it's better than i ever

1300

00:49:05,430 --> 00:49:03,119

imagined very nice

1301

00:49:08,230 --> 00:49:05,440

she's got her constellations oh

1302

00:49:10,309 --> 00:49:08,240

there's the telescope because she's

1303

00:49:11,990 --> 00:49:10,319

not just a sith lover she's an

1304

00:49:13,030 --> 00:49:12,000

astrophysicist

1305

00:49:14,870 --> 00:49:13,040

yes

1306

00:49:17,750 --> 00:49:14,880

come on up kimberly

1307

00:49:20,549 --> 00:49:17,760

grab his feet can't really

1308

00:49:23,670 --> 00:49:20,559

once you de-cloak there i think people

1309

00:49:26,470 --> 00:49:23,680

might recognize you

1310

00:49:30,150 --> 00:49:26,480

you've been with us before but why don't

1311

00:49:31,750 --> 00:49:30,160

you reintroduce yourself thank you tell

1312

00:49:34,870 --> 00:49:31,760

everybody who you are and what you do

1313

00:49:37,910 --> 00:49:34,880

here james i'm kimberly ennico smith i'm

1314

00:49:40,470 --> 00:49:37,920

a research astrophysicist

1315

00:49:44,150 --> 00:49:40,480

in my cosplay as a research

1316

00:49:49,190 --> 00:49:46,630

here at nasa ames research center in

1317

00:49:51,030 --> 00:49:49,200

silicon valley california yeah awesome

1318

00:49:52,790 --> 00:49:51,040

tell us a bit about what you're wearing

1319

00:49:54,230 --> 00:49:52,800

today

1320

00:49:55,750 --> 00:49:54,240

um as

1321

00:50:26,950 --> 00:49:55,760

a

1322

00:50:28,589 --> 00:50:26,960

tell us those connections

1323

00:50:32,470 --> 00:50:28,599

the kind of research you do an

1324

00:50:35,589 --> 00:50:32,480

astrophysicist studies the universe and

1325

00:50:37,589 --> 00:50:35,599

my training has been in a type of light

1326

00:50:39,030 --> 00:50:37,599

called the infrared

1327

00:50:41,109 --> 00:50:39,040

and

1328

00:50:43,270 --> 00:50:41,119

basically i'm interested in the dark

1329

00:50:45,510 --> 00:50:43,280

universe it's where parts of the

1330

00:50:46,630 --> 00:50:45,520

universe you cannot see with visible

1331

00:50:49,349 --> 00:50:46,640

light

1332

00:50:51,670 --> 00:50:49,359

and so i've built instruments that have

1333

00:50:54,950 --> 00:50:51,680

flown on space observatories and

1334

00:50:57,990 --> 00:50:54,960

airborne observatories that exploit this

1335

00:51:00,549 --> 00:50:58,000

light and peer into the dark universe

1336

00:51:02,390 --> 00:51:00,559

the dark universe i like that

1337

00:51:04,390 --> 00:51:02,400

but an astrophysicist is all about

1338

00:51:05,589 --> 00:51:04,400

trying to understand how the universe

1339

00:51:07,030 --> 00:51:05,599

works

1340

00:51:09,510 --> 00:51:07,040

how does it evolve

1341

00:51:12,790 --> 00:51:09,520

the physics behind it the chemistry the

1342

00:51:14,230 --> 00:51:12,800

mechanisms um to explain how we are here

1343

00:51:16,390 --> 00:51:14,240

today right

1344

00:51:19,510 --> 00:51:16,400

it's a big humbling task but worthy of a

1345

00:51:21,910 --> 00:51:19,520

sith lord well that's right

1346

00:51:23,430 --> 00:51:21,920

you fit your role so well i love it yeah

1347

00:51:25,349 --> 00:51:23,440

can you tell us a bit about how you

1348

00:51:27,270 --> 00:51:25,359

explore the universe the instruments

1349

00:51:30,390 --> 00:51:27,280

that you use or create

1350

00:51:32,950 --> 00:51:30,400

um yeah so um we see the universe with

1351  
00:51:36,069 --> 00:51:32,960  
our eyes if you go out at night you see

1352  
00:51:37,589 --> 00:51:36,079  
invisible wavelengths you see stars if

1353  
00:51:39,910 --> 00:51:37,599  
you have access to telescopes you can

1354  
00:51:42,790 --> 00:51:39,920  
see a lot more detail you can see deeper

1355  
00:51:44,790 --> 00:51:42,800  
you can see further yeah in the infrared

1356  
00:51:47,670 --> 00:51:44,800  
of built instruments that have peered

1357  
00:51:49,270 --> 00:51:47,680  
into the cocoons of stars being formed

1358  
00:51:52,069 --> 00:51:49,280  
which you couldn't see with your eyes

1359  
00:51:54,790 --> 00:51:52,079  
and appeared into the hearts of galaxies

1360  
00:51:57,190 --> 00:51:54,800  
to look at black holes that are fueling

1361  
00:51:58,950 --> 00:51:57,200  
the galaxies and that was enabled by

1362  
00:52:00,230 --> 00:51:58,960  
looking at the universe in the infrared

1363  
00:52:02,309 --> 00:52:00,240

okay wow

1364

00:52:04,790 --> 00:52:02,319

all that becomes possible when you're

1365

00:52:07,829 --> 00:52:04,800

not looking in only the light we can see

1366

00:52:09,750 --> 00:52:07,839

yeah so i mean the most universes is

1367

00:52:12,150 --> 00:52:09,760

revealing itself at other wavelengths

1368

00:52:14,390 --> 00:52:12,160

and today we live in exciting realm with

1369

00:52:16,069 --> 00:52:14,400

gravitational wave astronomy which is

1370

00:52:17,670 --> 00:52:16,079

opening up a new dimension to how we

1371

00:52:20,950 --> 00:52:17,680

understand the universe oh my gosh

1372

00:52:22,870 --> 00:52:20,960

exciting times to be an astrophysicist

1373

00:52:25,589 --> 00:52:22,880

we have some excitement in the chat a

1374

00:52:27,510 --> 00:52:25,599

bunch of comments for you caron says i

1375

00:52:30,950 --> 00:52:27,520

love her

1376

00:52:33,910 --> 00:52:30,960

bexart this is so nerdy and i love it

1377

00:52:36,710 --> 00:52:33,920

or no mck that dress is awesome alex the

1378

00:52:38,950 --> 00:52:36,720

unicat nerd i mean that in the most

1379

00:52:40,870 --> 00:52:38,960

affectionate way

1380

00:52:42,549 --> 00:52:40,880

well the dress is also glows in the dark

1381

00:52:44,390 --> 00:52:42,559

which is awesome

1382

00:52:45,670 --> 00:52:44,400

when you shine the lights on you turn

1383

00:52:47,829 --> 00:52:45,680

the lights off and then you have the

1384

00:52:50,309 --> 00:52:47,839

consolation oh my gosh it just got

1385

00:52:51,430 --> 00:52:50,319

better right now

1386

00:52:53,910 --> 00:52:51,440

amy

1387

00:52:55,829 --> 00:52:53,920

says first of all awesome and kimberly

1388

00:52:58,870 --> 00:52:55,839

what first you got what first got you

1389

00:53:01,430 --> 00:52:58,880

interested in your line of work wow um

1390

00:53:03,109 --> 00:53:01,440

well i was a nerd i'm a nerd today but

1391

00:53:06,069 --> 00:53:03,119

i'm a happy nerd yeah and i was a nerd

1392

00:53:08,470 --> 00:53:06,079

when i was a child and um i i got my

1393

00:53:10,630 --> 00:53:08,480

first telescope um when i was about

1394

00:53:12,630 --> 00:53:10,640

seven or eight years old i saved up my

1395

00:53:15,910 --> 00:53:12,640

um allowance money

1396

00:53:17,910 --> 00:53:15,920

and um i was recently reminded of

1397

00:53:19,430 --> 00:53:17,920

finding some journals i kept as a young

1398

00:53:22,150 --> 00:53:19,440

young child where i would take my

1399

00:53:24,309 --> 00:53:22,160

telescope out and i would plot the stars

1400

00:53:26,069 --> 00:53:24,319

and i would plot the moons of jupiter

1401

00:53:29,109 --> 00:53:26,079

and i was very conscious of how

1402

00:53:31,190 --> 00:53:29,119

beautiful the night sky is and um

1403

00:53:33,670 --> 00:53:31,200

we live in cities and night skies are

1404

00:53:35,910 --> 00:53:33,680

not as dark as more but you go camping

1405

00:53:36,549 --> 00:53:35,920

or you get away from the city lights it

1406

00:53:39,990 --> 00:53:36,559

is

1407

00:53:42,630 --> 00:53:40,000

just transformative i think to realize

1408

00:53:45,990 --> 00:53:42,640

we're on this little planet in such a

1409

00:53:48,069 --> 00:53:46,000

beautiful universe and all those stars

1410

00:53:49,750 --> 00:53:48,079

all harbor planets as well which has

1411

00:53:50,950 --> 00:53:49,760

been so transformative in the last

1412

00:53:52,549 --> 00:53:50,960

decade to learn that there's more

1413

00:53:53,750 --> 00:53:52,559

planets than stars out there that's

1414

00:53:55,750 --> 00:53:53,760

incredible

1415

00:53:56,710 --> 00:53:55,760

wow do you want to tell us some more

1416

00:53:58,230 --> 00:53:56,720

about

1417

00:54:00,870 --> 00:53:58,240

observatories and telescopes where

1418

00:54:03,270 --> 00:54:00,880

you've worked on instruments or

1419

00:54:04,790 --> 00:54:03,280

so i cut my teeth on

1420

00:54:06,549 --> 00:54:04,800

building an instrument for the spitzer

1421

00:54:07,990 --> 00:54:06,559

space telescope that was launched about

1422

00:54:10,069 --> 00:54:08,000

a decade ago it's just nearing the end

1423

00:54:11,430 --> 00:54:10,079

of its mission and that revealed the

1424

00:54:13,430 --> 00:54:11,440

infrared universe that we had not

1425

00:54:15,670 --> 00:54:13,440

explored these um very longer

1426

00:54:17,430 --> 00:54:15,680

wavelengths and we had learned a lot

1427

00:54:19,589 --> 00:54:17,440

about new types of phenomena and then i

1428

00:54:21,589 --> 00:54:19,599

built an instrument for a flying

1429

00:54:24,150 --> 00:54:21,599

observatory which also does infrared

1430

00:54:26,870 --> 00:54:24,160

observatory so sophia it's the world's

1431

00:54:28,630 --> 00:54:26,880

largest flying infrared observatory

1432

00:54:29,829 --> 00:54:28,640

today yeah that's got a plane with a

1433

00:54:34,950 --> 00:54:29,839

telescope

1434

00:54:36,470 --> 00:54:34,960

also revealed and i built a spectrometer

1435

00:54:38,069 --> 00:54:36,480

for that one and that was all about

1436

00:54:39,670 --> 00:54:38,079

understanding the chemical fingerprints

1437

00:54:42,630 --> 00:54:39,680

as you know trying to understand the

1438

00:54:44,870 --> 00:54:42,640

makeup of the universe

1439

00:54:48,789 --> 00:54:44,880

and um the community is very excited

1440

00:54:51,190 --> 00:54:48,799

about the most ambitious infrared space

1441

00:54:53,589 --> 00:54:51,200

telescope to be launched in about a year

1442

00:54:55,349 --> 00:54:53,599

and a half from now not too long james

1443

00:54:56,710 --> 00:54:55,359

webb space telescope

1444

00:54:59,109 --> 00:54:56,720

yeah

1445

00:55:00,630 --> 00:54:59,119

the james webb is a successor to hubble

1446

00:55:02,870 --> 00:55:00,640

i didn't mention hubble hubble's an

1447

00:55:04,309 --> 00:55:02,880

amazing observatory right now and just

1448

00:55:05,270 --> 00:55:04,319

transformed the way we understand the

1449

00:55:06,870 --> 00:55:05,280

universe

1450

00:55:08,470 --> 00:55:06,880

that has worked in the ultraviolet

1451

00:55:10,150 --> 00:55:08,480

invisible with a little bit of infrared

1452

00:55:12,069 --> 00:55:10,160

but it's been most sensitive and the

1453

00:55:15,109 --> 00:55:12,079

show demonstrated the power

1454

00:55:17,430 --> 00:55:15,119

of putting a telescope in space oh yes

1455

00:55:20,069 --> 00:55:17,440

james webb is very different

1456

00:55:21,430 --> 00:55:20,079

and james webb is going to be the

1457

00:55:24,630 --> 00:55:21,440

biggest

1458

00:55:27,430 --> 00:55:24,640

observatory we have put in space wow

1459

00:55:30,230 --> 00:55:27,440

um a collecting area almost seven times

1460

00:55:32,710 --> 00:55:30,240

larger than hubble with a sensitivity a

1461

00:55:33,589 --> 00:55:32,720

hundred times more sensitive than hubble

1462

00:55:36,230 --> 00:55:33,599

that's

1463

00:55:38,710 --> 00:55:36,240

hubble is already incredible with the

1464

00:55:39,829 --> 00:55:38,720

images it gives us but what's going to

1465

00:55:43,190 --> 00:55:39,839

be

1466

00:55:44,390 --> 00:55:43,200

what gets me excited about james webb

1467

00:55:47,349 --> 00:55:44,400

it's

1468

00:55:49,829 --> 00:55:47,359

the first time we've had a telescope to

1469

00:55:53,109 --> 00:55:49,839

look at the birth of galaxies we have

1470

00:55:54,390 --> 00:55:53,119

never had an observatory that can look

1471

00:55:56,390 --> 00:55:54,400

that deep

1472

00:55:58,870 --> 00:55:56,400

um into the universe because of its

1473

00:56:01,030 --> 00:55:58,880

sensitivity and also exploiting the

1474

00:56:04,789 --> 00:56:01,040

infrared to peer deeper into the

1475

00:56:07,349 --> 00:56:04,799

universe uh that will potentially catch

1476

00:56:09,349 --> 00:56:07,359

the birth of galaxies

1477

00:56:10,549 --> 00:56:09,359

we will see very beginnings baby

1478

00:56:29,750 --> 00:56:10,559

galaxies

1479

00:56:32,470 --> 00:56:31,430

work themselves out

1480

00:56:34,870 --> 00:56:32,480

um the

1481

00:56:36,870 --> 00:56:34,880

baby or the birth of galaxies is very

1482

00:56:38,069 --> 00:56:36,880

unknown one of the biggest unknown

1483

00:56:39,030 --> 00:56:38,079

questions

1484

00:56:41,670 --> 00:56:39,040

is

1485

00:56:44,470 --> 00:56:41,680

you know how do the galaxies form and

1486

00:56:46,309 --> 00:56:44,480

one in particular

1487

00:56:48,789 --> 00:56:46,319

we now have observed over the last

1488

00:56:51,270 --> 00:56:48,799

couple of decades that

1489

00:56:54,630 --> 00:56:51,280

all the large massive galaxies are

1490

00:56:56,390 --> 00:56:54,640

fueled by a supermassive black hole

1491

00:56:58,549 --> 00:56:56,400

these are black holes

1492

00:57:00,549 --> 00:56:58,559

that are thousands to millions to

1493

00:57:03,750 --> 00:57:00,559

billions of solar masses these are

1494

00:57:05,750 --> 00:57:03,760

incredible beasts wow we have no idea

1495

00:57:07,750 --> 00:57:05,760

how they form

1496

00:57:11,349 --> 00:57:07,760

nor do we know whether you need a

1497

00:57:14,309 --> 00:57:11,359

supermassive black hole to form a galaxy

1498

00:57:17,190 --> 00:57:14,319

or whether the galaxy as it got massive

1499

00:57:19,030 --> 00:57:17,200

for the super massive black hole wow we

1500

00:57:21,910 --> 00:57:19,040

have a chicken and egg

1501  
00:57:23,349 --> 00:57:21,920  
dilemma so james webb

1502  
00:57:26,069 --> 00:57:23,359  
is gonna

1503  
00:57:29,190 --> 00:57:26,079  
tell us oh my gosh wow did black holes

1504  
00:57:31,270 --> 00:57:29,200  
come first right or did gallows

1505  
00:57:32,630 --> 00:57:31,280  
wow yeah i didn't even realize that we

1506  
00:57:34,150 --> 00:57:32,640  
didn't know these things we didn't know

1507  
00:57:36,309 --> 00:57:34,160  
these things

1508  
00:57:38,630 --> 00:57:36,319  
so much more to learn right yeah yeah i

1509  
00:57:42,230 --> 00:57:38,640  
think we have an animation we do of

1510  
00:57:44,630 --> 00:57:42,240  
james webb space telescope yeah

1511  
00:57:46,630 --> 00:57:44,640  
this is a um the most going to be the

1512  
00:57:49,349 --> 00:57:46,640  
largest space telescope ever launched

1513  
00:57:53,510 --> 00:57:49,359

it's going to launch in march of 2021

1514

00:57:55,910 --> 00:57:53,520

you see a 18 um segmented primary mirror

1515

00:57:59,510 --> 00:57:55,920

that's coated in gold the diameter is

1516

00:58:01,589 --> 00:57:59,520

6.5 meters about the height of a giraffe

1517

00:58:04,470 --> 00:58:01,599

the um the bottom part that looks

1518

00:58:06,309 --> 00:58:04,480

silvery purple is a sun shade the sun

1519

00:58:07,349 --> 00:58:06,319

shades about the size of the tennis

1520

00:58:09,829 --> 00:58:07,359

court

1521

00:58:12,789 --> 00:58:09,839

this is going to be launched to an orbit

1522

00:58:15,069 --> 00:58:12,799

around the sun a million miles from

1523

00:58:17,990 --> 00:58:15,079

earth wow i mean hubble right now is at

1524

00:58:19,670 --> 00:58:18,000

375 miles from earth so this is a very

1525

00:58:22,309 --> 00:58:19,680

different way of running a space

1526

00:58:24,789 --> 00:58:22,319

telescope with its large aperture and

1527

00:58:26,710 --> 00:58:24,799

its um ability to look in the infrared

1528

00:58:29,030 --> 00:58:26,720

it's cooled um this

1529

00:58:31,670 --> 00:58:29,040

gives it a lot more sensitivity

1530

00:58:36,789 --> 00:58:31,680

and um yes it's going to really reveal

1531

00:58:41,190 --> 00:58:39,190

and not to play up the star wars thing

1532

00:58:44,549 --> 00:58:41,200

it is going to bring

1533

00:58:47,190 --> 00:58:44,559

galaxies far far away

1534

00:58:49,990 --> 00:58:47,200

very much closer to home and it's really

1535

00:58:52,950 --> 00:58:50,000

an observatory about the first stars and

1536

00:58:55,510 --> 00:58:52,960

the first galaxies wow amazing yeah what

1537

00:58:58,069 --> 00:58:55,520

a good story i can't wait now i always

1538

00:58:59,670 --> 00:58:58,079

love and kimberly i know i love

1539

00:59:01,589 --> 00:58:59,680

hearing you speak

1540

00:59:03,829 --> 00:59:01,599

uh but before we have to let you go

1541

00:59:05,670 --> 00:59:03,839

let's get a couple questions in here uh

1542

00:59:07,190 --> 00:59:05,680

valasparkle asks what's the coolest

1543

00:59:08,309 --> 00:59:07,200

thing that you ever saw looking into

1544

00:59:11,109 --> 00:59:08,319

space

1545

00:59:14,150 --> 00:59:11,119

okay wow can you name just one is that

1546

00:59:16,710 --> 00:59:14,160

it's difficult um i was very privileged

1547

00:59:19,910 --> 00:59:16,720

to um work on the new horizons mission

1548

00:59:22,069 --> 00:59:19,920

that flew by pluto in 2015. i was one of

1549

00:59:25,589 --> 00:59:22,079

the deputy project science fair

1550

00:59:27,430 --> 00:59:25,599

and to actually see a world that had

1551

00:59:30,069 --> 00:59:27,440

been just 10 pixels in the hubble space

1552

00:59:32,549 --> 00:59:30,079

telescope camera very blurry and have it

1553

00:59:34,549 --> 00:59:32,559

come into life and to full color

1554

00:59:37,750 --> 00:59:34,559

showing glaciers

1555

00:59:39,270 --> 00:59:37,760

was the most unexpected phenomena that

1556

00:59:40,870 --> 00:59:39,280

no one had expected now i know it's

1557

00:59:43,190 --> 00:59:40,880

closer to home rather than the black

1558

00:59:45,990 --> 00:59:43,200

holes and the exotic dark matter dark

1559

00:59:47,109 --> 00:59:46,000

energy that is shaping our larger

1560

00:59:49,589 --> 00:59:47,119

universe

1561

00:59:52,309 --> 00:59:49,599

it's like the fact that we have a lot

1562

00:59:54,870 --> 00:59:52,319

yet to still discover in our home

1563

00:59:57,589 --> 00:59:54,880

backyard oh yeah yeah yeah um so that

1564

00:59:59,109 --> 00:59:57,599

was just phenomena i we no one expected

1565

01:00:01,510 --> 00:59:59,119

that's amazing your science has taken

1566

01:00:02,789 --> 01:00:01,520

you near and far hasn't it yeah well

1567

01:00:04,390 --> 01:00:02,799

we studied the universe we want to

1568

01:00:06,789 --> 01:00:04,400

understand and plus when we understand

1569

01:00:09,750 --> 01:00:06,799

that there are more planets than stars

1570

01:00:11,190 --> 01:00:09,760

stars hosting lots of these exoplanets

1571

01:00:13,030 --> 01:00:11,200

and trying to understand our solar

1572

01:00:14,630 --> 01:00:13,040

system in context and we have a

1573

01:00:16,870 --> 01:00:14,640

laboratory here trying to send our own

1574

01:00:18,870 --> 01:00:16,880

solar system but then we have thousands

1575

01:00:20,630 --> 01:00:18,880

and now millions of solar systems yet to

1576

01:00:23,349 --> 01:00:20,640

be explored that's right

1577

01:00:24,870 --> 01:00:23,359

there's so much more to do exciting all

1578

01:00:26,950 --> 01:00:24,880

right well

1579

01:00:28,549 --> 01:00:26,960

i guess our last question for you is how

1580

01:00:31,670 --> 01:00:28,559

could we recreate your look for

1581

01:00:34,950 --> 01:00:31,680

halloween well um go to a fabric store

1582

01:00:37,990 --> 01:00:34,960

and make a black cloak yes

1583

01:00:39,829 --> 01:00:38,000

um for my dress um i just looked for a

1584

01:00:42,549 --> 01:00:39,839

constellation dress online it's been

1585

01:00:44,630 --> 01:00:42,559

great at parties conversation starter

1586

01:00:47,510 --> 01:00:44,640

for the lightsaber i borrowed one off a

1587

01:00:48,870 --> 01:00:47,520

friend's teenage um child

1588

01:00:50,309 --> 01:00:48,880

that's a good song but if you want to

1589

01:00:53,190 --> 01:00:50,319

make one at home

1590

01:00:55,349 --> 01:00:53,200

just take a clear plastic tube

1591

01:00:56,470 --> 01:00:55,359

and attach it to a flashlight with some

1592

01:00:59,510 --> 01:00:56,480

duct tape

1593

01:01:01,510 --> 01:00:59,520

and i've learned that if i uh if i uh

1594

01:01:03,589 --> 01:01:01,520

sanded the outer side of the just to

1595

01:01:05,109 --> 01:01:03,599

make it look more opaque i created some

1596

01:01:06,390 --> 01:01:05,119

diffusion effect and i was able to

1597

01:01:09,270 --> 01:01:06,400

scattering light effect and i got to see

1598

01:01:11,670 --> 01:01:09,280

my lightsaber just a tube and a duct

1599

01:01:13,430 --> 01:01:11,680

tape and uh perfect do it yourself

1600

01:01:15,750 --> 01:01:13,440

project for halloween right right

1601  
01:01:17,190 --> 01:01:15,760  
totally doable i think all right well

1602  
01:01:19,829 --> 01:01:17,200  
thanks for the tips and also the

1603  
01:01:21,829 --> 01:01:19,839  
wonderful stories about your science yes

1604  
01:01:24,069 --> 01:01:21,839  
love it and exploring the universe yes

1605  
01:01:26,870 --> 01:01:24,079  
and may the force be with oh and

1606  
01:01:29,829 --> 01:01:26,880  
absolutely with all of us yes thanks for

1607  
01:01:31,750 --> 01:01:29,839  
just we learned about the dark universe

1608  
01:01:33,270 --> 01:01:31,760  
fabulous well thank you and we will

1609  
01:01:35,430 --> 01:01:33,280  
bring you back out later when it's time

1610  
01:01:38,870 --> 01:01:35,440  
to vote on our favorite costumes yeah

1611  
01:01:40,150 --> 01:01:38,880  
thank you thank you really fabulous and

1612  
01:01:41,270 --> 01:01:40,160  
you could just listen to kimberly all

1613  
01:01:42,789 --> 01:01:41,280

day couldn't you i mean really you

1614

01:01:45,510 --> 01:01:42,799

really could yes

1615

01:01:46,789 --> 01:01:45,520

yes and just be mesmerized yes

1616

01:02:04,150 --> 01:01:46,799

you know you almost feel like you're

1617

01:02:08,150 --> 01:02:06,230

this pair boldly goes through their work

1618

01:02:10,789 --> 01:02:08,160

day advancing the science of flight at

1619

01:02:13,990 --> 01:02:10,799

our flight simulator facilities come on

1620

01:02:16,230 --> 01:02:14,000

out sumeeta and emily cosplaying as

1621

01:02:19,589 --> 01:02:16,240

nasa's starfleet command

1622

01:02:26,470 --> 01:02:22,630

very nice oh yeah

1623

01:02:29,029 --> 01:02:26,480

hey come on up here have a seat

1624

01:02:31,109 --> 01:02:29,039

you look so good yes

1625

01:02:33,750 --> 01:02:31,119

and i love that you have these costumes

1626  
01:02:35,270 --> 01:02:33,760  
me too of course those

1627  
01:02:36,549 --> 01:02:35,280  
trek

1628  
01:02:38,069 --> 01:02:36,559  
costumes

1629  
01:02:39,990 --> 01:02:38,079  
perfect

1630  
01:02:41,750 --> 01:02:40,000  
so do you guys want to tell us your name

1631  
01:02:44,630 --> 01:02:41,760  
and what you do

1632  
01:02:46,829 --> 01:02:44,640  
hi i'm sumeda and i work at the flight

1633  
01:02:49,510 --> 01:02:46,839  
simulation labs as outreach and

1634  
01:02:51,750 --> 01:02:49,520  
communications nice and my name is emily

1635  
01:02:54,390 --> 01:02:51,760  
lewis i'm a simulation engineer

1636  
01:02:56,230 --> 01:02:54,400  
contractor at uh sim labs at here at

1637  
01:02:58,390 --> 01:02:56,240  
nasa ames all right you're going to tell

1638  
01:03:00,470 --> 01:02:58,400

us lots more about that

1639

01:03:03,910 --> 01:03:00,480

i know what you're wearing

1640

01:03:05,270 --> 01:03:03,920

star trek uniforms uh but tell us why

1641

01:03:07,990 --> 01:03:05,280

because i know there's a connection to

1642

01:03:10,069 --> 01:03:08,000

your work here uh yes so as a kid i

1643

01:03:12,470 --> 01:03:10,079

watched star trek uh growing up with my

1644

01:03:14,710 --> 01:03:12,480

dad at the reruns and i was really

1645

01:03:17,829 --> 01:03:14,720

inspired by lieutenant uhura

1646

01:03:20,950 --> 01:03:17,839

the communications officer and so my

1647

01:03:23,270 --> 01:03:20,960

costume is uh similar to that and

1648

01:03:26,069 --> 01:03:23,280

you know of course uh star trek uh with

1649

01:03:28,630 --> 01:03:26,079

its uh mission to do discovery and

1650

01:03:30,870 --> 01:03:28,640

explore is um you know very similar to

1651  
01:03:33,270 --> 01:03:30,880  
kind of what our mission is at the

1652  
01:03:35,349 --> 01:03:33,280  
simulation facilities to advance science

1653  
01:03:37,109 --> 01:03:35,359  
for that for that reason yeah it makes

1654  
01:03:39,029 --> 01:03:37,119  
perfect sense

1655  
01:03:40,870 --> 01:03:39,039  
and i'm wearing a next generation star

1656  
01:03:43,349 --> 01:03:40,880  
trek costume and i fell in love with

1657  
01:03:44,870 --> 01:03:43,359  
star trek um when next generation was on

1658  
01:03:46,950 --> 01:03:44,880  
when i was in college so i watched in

1659  
01:03:49,670 --> 01:03:46,960  
college and i found the vision of star

1660  
01:03:51,910 --> 01:03:49,680  
trek and its positive approach to space

1661  
01:03:53,829 --> 01:03:51,920  
exploration and tech technology really

1662  
01:03:55,510 --> 01:03:53,839  
inspiring and that's one of the main

1663  
01:03:57,190 --> 01:03:55,520

reasons that i decided to study

1664

01:03:59,029 --> 01:03:57,200

aerospace engineering and why also i'm

1665

01:04:01,270 --> 01:03:59,039

really happy to be working on nasa here

1666

01:04:03,430 --> 01:04:01,280

yeah and one other connection that we

1667

01:04:06,230 --> 01:04:03,440

have between star trek and where we work

1668

01:04:07,670 --> 01:04:06,240

at the simulation laboratory uh is that

1669

01:04:09,270 --> 01:04:07,680

star trek has a holodeck if you're

1670

01:04:10,829 --> 01:04:09,280

familiar with it the holodeck is kind of

1671

01:04:12,390 --> 01:04:10,839

a really cool

1672

01:04:14,950 --> 01:04:12,400

high-tech

1673

01:04:16,950 --> 01:04:14,960

virtual reality simulation facility yeah

1674

01:04:19,430 --> 01:04:16,960

and you know we don't have a holodeck

1675

01:04:21,190 --> 01:04:19,440

but we are thinking about including vr

1676

01:04:23,910 --> 01:04:21,200

uh sometime in the future but we are

1677

01:04:26,390 --> 01:04:23,920

advancing uh aerospace technologies and

1678

01:04:28,950 --> 01:04:26,400

we are supporting the development of the

1679

01:04:31,510 --> 01:04:28,960

next generation aircraft and spacecraft

1680

01:04:33,510 --> 01:04:31,520

yeah yeah yeah right so tell us what

1681

01:04:35,589 --> 01:04:33,520

the simulation labs means you guys have

1682

01:04:37,270 --> 01:04:35,599

a flight simulator right why don't you

1683

01:04:39,270 --> 01:04:37,280

tell everybody about that one so the

1684

01:04:42,069 --> 01:04:39,280

flight simulator can really um become

1685

01:04:44,470 --> 01:04:42,079

any aircraft or spacecraft and to test

1686

01:04:47,430 --> 01:04:44,480

out new designs do research for

1687

01:04:48,870 --> 01:04:47,440

uh you know any kind of new aircraft and

1688

01:04:50,710 --> 01:04:48,880

uh maybe emily can tell us a little bit

1689

01:04:53,029 --> 01:04:50,720

more about the vertical motion simulator

1690

01:04:54,309 --> 01:04:53,039

because that's where she's at yeah yeah

1691

01:04:56,069 --> 01:04:54,319

the simulation laboratories has the

1692

01:04:58,470 --> 01:04:56,079

several facilities and the vertical

1693

01:05:01,430 --> 01:04:58,480

motion simulator is where i work most of

1694

01:05:03,510 --> 01:05:01,440

the time we call that the vms and the

1695

01:05:05,349 --> 01:05:03,520

vertical motion simulator the vms uh is

1696

01:05:07,109 --> 01:05:05,359

the largest um

1697

01:05:09,589 --> 01:05:07,119

so it's a full motion

1698

01:05:11,349 --> 01:05:09,599

real-time piloted simulation facility

1699

01:05:13,190 --> 01:05:11,359

and it has the largest vertical motion

1700

01:05:16,549 --> 01:05:13,200

space of any ground-based simulator in

1701

01:05:18,710 --> 01:05:16,559

the world amazing yes and so it is

1702

01:05:20,390 --> 01:05:18,720

designed to be reconfigurable and

1703

01:05:23,990 --> 01:05:20,400

customizable and so we can basically

1704

01:05:25,990 --> 01:05:24,000

simulate any you know vehicle real or

1705

01:05:28,309 --> 01:05:26,000

not real notional uh that you need to

1706

01:05:31,829 --> 01:05:28,319

set it really so yeah yeah so sometimes

1707

01:05:36,950 --> 01:05:31,839

it can be a boat or it could be a plane

1708

01:05:42,069 --> 01:05:39,430

it can be a spacecraft we've done um

1709

01:05:45,910 --> 01:05:42,079

we've done helicopters you know jets

1710

01:05:47,910 --> 01:05:45,920

transports and we did a bobsled wow i

1711

01:05:50,470 --> 01:05:47,920

didn't work on that one

1712

01:05:52,230 --> 01:05:50,480

yeah they actually dropped some

1713

01:06:09,990 --> 01:05:52,240

fruit flies once to see how they would

1714

01:06:11,910 --> 01:06:10,789

and

1715

01:06:14,069 --> 01:06:11,920

as i said it's the largest vertical

1716

01:06:15,109 --> 01:06:14,079

motion simulator of any in the world it

1717

01:06:18,789 --> 01:06:15,119

can move

1718

01:06:24,630 --> 01:06:18,799

plus 60 feet vertically and

1719

01:06:29,589 --> 01:06:27,589

and we it offers six we call it six

1720

01:06:31,990 --> 01:06:29,599

degrees of six uncoupled degrees of

1721

01:06:33,750 --> 01:06:32,000

freedom and i'll explain what that means

1722

01:06:37,829 --> 01:06:33,760

uh in a minute when the video is done

1723

01:06:41,029 --> 01:06:37,839

yeah okay okay so we have this model

1724

01:06:42,870 --> 01:06:41,039

uh of one of our our vms cabs

1725

01:06:45,589 --> 01:06:42,880

and just to give you a perspective the

1726

01:06:48,150 --> 01:06:45,599

the pilots sit inside this cab and this

1727

01:06:49,829 --> 01:06:48,160

might fit maybe three or four people and

1728

01:06:51,829 --> 01:06:49,839

inside the cab

1729

01:06:53,750 --> 01:06:51,839

would be configured to be whatever

1730

01:06:56,150 --> 01:06:53,760

vehicle you wanted to simulate

1731

01:06:59,349 --> 01:06:56,160

and the vms would sit in that 10 story

1732

01:07:01,270 --> 01:06:59,359

tower and it sits along a beam that

1733

01:07:03,990 --> 01:07:01,280

is what goes along the the axis of the

1734

01:07:04,789 --> 01:07:04,000

40-foot long beam b moves up and down

1735

01:07:06,470 --> 01:07:04,799

uh

1736

01:07:08,470 --> 01:07:06,480

to give the vertical motion and then the

1737

01:07:09,349 --> 01:07:08,480

cav moves along the beam for the lateral

1738

01:07:10,950 --> 01:07:09,359

motion

1739

01:07:12,950 --> 01:07:10,960

and then it moves perpendicular to the

1740

01:07:14,230 --> 01:07:12,960

beam for the longitudinal motion and

1741

01:07:15,190 --> 01:07:14,240

that's the three translational degrees

1742

01:07:17,349 --> 01:07:15,200

of freedom

1743

01:07:20,069 --> 01:07:17,359

and then it also sits on a

1744

01:07:21,829 --> 01:07:20,079

hydraulic gimbal system to provide the

1745

01:07:23,190 --> 01:07:21,839

rotations and so

1746

01:07:26,150 --> 01:07:23,200

this is the front of the cab so the

1747

01:07:28,069 --> 01:07:26,160

rotational axis would be roll

1748

01:07:30,950 --> 01:07:28,079

and then this would be pitch yeah and

1749

01:07:32,789 --> 01:07:30,960

yeah okay and when we say six uncouple

1750

01:07:34,390 --> 01:07:32,799

degrees of freedom what we mean is that

1751

01:07:36,870 --> 01:07:34,400

for instance if it has a long a large

1752

01:07:38,470 --> 01:07:36,880

deflection in one axis it doesn't have

1753

01:07:55,430 --> 01:07:38,480

it doesn't reduce the amount of travel

1754

01:07:59,349 --> 01:07:56,870

sure and we've had

1755

01:08:18,630 --> 01:07:59,359

several astronauts train at the

1756

01:08:23,349 --> 01:08:20,870

it's important for us to live long and

1757

01:08:25,030 --> 01:08:23,359

prosper

1758

01:08:27,749 --> 01:08:25,040

and so uh building a plane and

1759

01:08:29,829 --> 01:08:27,759

simulation is obviously a lot safer and

1760

01:08:31,910 --> 01:08:29,839

it's more cost effective and so they can

1761

01:08:34,550 --> 01:08:31,920

test out the new ideas test out new

1762

01:08:37,110 --> 01:08:34,560

procedures see how we want to do this

1763

01:08:38,950 --> 01:08:37,120

before actually flying in real life yeah

1764

01:08:41,269 --> 01:08:38,960

awesome and then you've had astronauts

1765

01:08:43,910 --> 01:08:41,279

training in that yeah every single uh

1766

01:08:45,749 --> 01:08:43,920

shuttle um pilot trained at the vertical

1767

01:08:48,309 --> 01:08:45,759

motion simulator for landing yes

1768

01:08:50,789 --> 01:08:48,319

fantastic what a claim to fame

1769

01:08:51,990 --> 01:08:50,799

and the shuttle pilots who flew at the

1770

01:08:53,349 --> 01:08:52,000

simulator and then actually flew in

1771

01:08:55,590 --> 01:08:53,359

space and came back said that the

1772

01:08:57,829 --> 01:08:55,600

simulator really represented what they

1773

01:08:59,430 --> 01:08:57,839

felt accurately so oh wow really good

1774

01:09:02,149 --> 01:08:59,440

that's really impressive yeah for a

1775

01:09:04,789 --> 01:09:02,159

facility on the ground yeah that has to

1776

01:09:06,789 --> 01:09:04,799

make it up right right exactly yeah

1777

01:09:09,189 --> 01:09:06,799

well we have some comments and questions

1778

01:09:11,990 --> 01:09:09,199

yeah yes we have

1779

01:09:14,950 --> 01:09:12,000

amy here uh says my question is how are

1780

01:09:21,910 --> 01:09:16,870

i'm sure you're talking about tomato

1781

01:09:25,990 --> 01:09:24,390

working here is so awesome and uh with

1782

01:09:28,470 --> 01:09:26,000

the artemis mission

1783

01:09:30,550 --> 01:09:28,480

coming up sending the first woman and

1784

01:09:33,189 --> 01:09:30,560

next man to walk on the surface of the

1785

01:09:35,590 --> 01:09:33,199

moon that is super exciting super cool

1786

01:09:37,110 --> 01:09:35,600

in 2024 yes

1787

01:09:40,709 --> 01:09:37,120

yeah i think that leads us into a

1788

01:09:43,349 --> 01:09:40,719

question too from from the chat uh rg rj

1789

01:09:45,590 --> 01:09:43,359

the noob uh did they test any landing

1790

01:09:47,510 --> 01:09:45,600

simulations for any lunar landers

1791

01:09:49,669 --> 01:09:47,520

uh yes that's a great question glad i'm

1792

01:09:52,149 --> 01:09:49,679

glad you asked that because we've had

1793

01:09:54,550 --> 01:09:52,159

several lunar lander studies done

1794

01:09:57,189 --> 01:09:54,560

and what they learned is that landing

1795

01:09:59,830 --> 01:09:57,199

the moon is uh very

1796

01:10:01,750 --> 01:09:59,840

difficult from a control point of view

1797

01:10:04,870 --> 01:10:01,760

and so motion-based simulation is

1798

01:10:06,709 --> 01:10:04,880

critical for um analyzing and testing

1799

01:10:09,990 --> 01:10:06,719

and making sure that the next generation

1800

01:10:11,830 --> 01:10:10,000

lunar lander will um be uh be a really

1801  
01:10:12,709 --> 01:10:11,840  
great for the artemis astronauts here

1802  
01:10:14,229 --> 01:10:12,719  
wow

1803  
01:10:16,870 --> 01:10:14,239  
that's amazing that you can simulate

1804  
01:10:18,630 --> 01:10:16,880  
that as well i know right yeah i think

1805  
01:10:20,470 --> 01:10:18,640  
we have a video of this as well with the

1806  
01:10:22,070 --> 01:10:20,480  
little anderson how great oh fabulous

1807  
01:10:22,870 --> 01:10:22,080  
you've got one excellent i want to see

1808  
01:10:24,630 --> 01:10:22,880  
that

1809  
01:10:26,950 --> 01:10:24,640  
the lunar lander zoom

1810  
01:10:28,950 --> 01:10:26,960  
yes this is the lunar lander simulation

1811  
01:10:32,630 --> 01:10:28,960  
cab the interior of it so you can see

1812  
01:10:35,030 --> 01:10:32,640  
the um the displays there and there's me

1813  
01:10:37,669 --> 01:10:35,040

it looks like the moon up there uh yeah

1814

01:10:39,510 --> 01:10:37,679

yeah so so we have the moon simulated uh

1815

01:10:41,430 --> 01:10:39,520

there for the landing and you can see

1816

01:10:43,430 --> 01:10:41,440

the bird's eye view over here and so the

1817

01:10:45,510 --> 01:10:43,440

researchers actually get to have

1818

01:10:47,750 --> 01:10:45,520

many different points of view at this

1819

01:10:50,390 --> 01:10:47,760

research facility so they can really

1820

01:10:52,310 --> 01:10:50,400

test um and see from all angles see how

1821

01:10:54,950 --> 01:10:52,320

they might want to make improvements

1822

01:10:57,270 --> 01:10:54,960

and and make those changes in the future

1823

01:10:58,950 --> 01:10:57,280

awesome that's awesome yeah so great

1824

01:11:02,070 --> 01:10:58,960

yeah all right

1825

01:11:04,870 --> 01:11:02,080

2024. yeah

1826

01:11:07,270 --> 01:11:04,880

got the countdown here right

1827

01:11:09,830 --> 01:11:07,280

so we're gonna have to keep moving and

1828

01:11:11,350 --> 01:11:09,840

have our next contenders come on but how

1829

01:11:12,470 --> 01:11:11,360

can we recreate your looks do you guys

1830

01:11:14,310 --> 01:11:12,480

have advice

1831

01:11:16,630 --> 01:11:14,320

uh well

1832

01:11:19,030 --> 01:11:16,640

what's really uh nice about the original

1833

01:11:21,350 --> 01:11:19,040

star trek series is the costumes are

1834

01:11:23,430 --> 01:11:21,360

pretty simple you can get a

1835

01:11:26,950 --> 01:11:23,440

boldly colored shirt maybe

1836

01:11:28,790 --> 01:11:26,960

red or blue add some ribbon to the cuffs

1837

01:11:31,110 --> 01:11:28,800

maybe add a black shirt underneath that

1838

01:11:32,149 --> 01:11:31,120

peeks out so you can simulate having the

1839

01:11:34,630 --> 01:11:32,159

trim

1840

01:11:36,070 --> 01:11:34,640

you stimulate everything simulate

1841

01:11:38,470 --> 01:11:36,080

and then uh you know maybe add black

1842

01:11:41,750 --> 01:11:38,480

boots uh black pants of course you want

1843

01:11:44,790 --> 01:11:41,760

to have a star trek pin or you can 3d

1844

01:11:46,149 --> 01:11:44,800

print your own communicator if you like

1845

01:11:48,390 --> 01:11:46,159

and then you'll have your starfleet

1846

01:11:50,470 --> 01:11:48,400

uniform excellent nice that's good

1847

01:11:52,630 --> 01:11:50,480

advice yeah all right

1848

01:11:54,950 --> 01:11:52,640

well thank you thank you for joining us

1849

01:11:56,870 --> 01:11:54,960

has been fascinating and we will can i

1850

01:11:58,790 --> 01:11:56,880

say one more star trek thing without a

1851  
01:12:00,630 --> 01:11:58,800  
simulation i just wanted to say that if

1852  
01:12:02,550 --> 01:12:00,640  
you want to uh boldly go where no one

1853  
01:12:04,390 --> 01:12:02,560  
has gone before yeah and do it safely

1854  
01:12:06,390 --> 01:12:04,400  
then you need to include simulation in

1855  
01:12:09,270 --> 01:12:06,400  
your design process absolutely

1856  
01:12:11,510 --> 01:12:09,280  
absolutely yeah be true thank you this

1857  
01:12:13,270 --> 01:12:11,520  
has been really cool and we'll see you

1858  
01:12:14,950 --> 01:12:13,280  
in a little bit thank you thanks for

1859  
01:12:16,149 --> 01:12:14,960  
coming thanks

1860  
01:12:19,669 --> 01:12:16,159  
all right

1861  
01:12:22,070 --> 01:12:19,679  
i love the variety of costumes and

1862  
01:12:24,709 --> 01:12:22,080  
yeah fields of study and techniques

1863  
01:12:26,630 --> 01:12:24,719

these guys use also just like they can

1864

01:12:28,229 --> 01:12:26,640

like clear connections to like pop

1865

01:12:30,709 --> 01:12:28,239

culture stuff like you know star wars

1866

01:12:32,310 --> 01:12:30,719

star trek it's just like so easy to

1867

01:12:34,830 --> 01:12:32,320

connect yeah i don't think these are

1868

01:12:37,750 --> 01:12:34,840

that much of a stretch no not at all

1869

01:12:40,149 --> 01:12:37,760

astrophysicist i mean who hasn't met one

1870

01:12:42,390 --> 01:12:40,159

of those

1871

01:12:44,630 --> 01:12:42,400

okay so should we go to yeah you want to

1872

01:12:46,950 --> 01:12:44,640

bring on the next one okay yes so we

1873

01:12:48,790 --> 01:12:46,960

have an intro as well so she is the

1874

01:12:51,270 --> 01:12:48,800

daughter of zeus and twin sister of

1875

01:12:53,430 --> 01:12:51,280

apollo now this greek goddess shares the

1876

01:12:55,750 --> 01:12:53,440

name of our program that will return

1877

01:12:58,470 --> 01:12:55,760

humans to the moon come on out daisy

1878

01:13:00,950 --> 01:12:58,480

cosplaying as artemis

1879

01:13:07,270 --> 01:13:00,960

let's see this

1880

01:13:14,310 --> 01:13:09,430

[Music]

1881

01:13:18,870 --> 01:13:16,950

keep that handy great thank you come on

1882

01:13:20,550 --> 01:13:18,880

right up here

1883

01:13:22,310 --> 01:13:20,560

yeah it's hard to see yeah

1884

01:13:24,310 --> 01:13:22,320

there's a nice moon you got there thank

1885

01:13:26,149 --> 01:13:24,320

you so much go ahead and get out of the

1886

01:13:27,910 --> 01:13:26,159

way here why don't you introduce

1887

01:13:29,590 --> 01:13:27,920

yourself and tell everybody what you do

1888

01:13:31,750 --> 01:13:29,600

here yeah so my name is daisy stock and

1889

01:13:33,510 --> 01:13:31,760

i'm an intern in the exobiology branch

1890

01:13:34,870 --> 01:13:33,520

um and we're concerned with origin of

1891

01:13:36,950 --> 01:13:34,880

life chemistry

1892

01:13:39,189 --> 01:13:36,960

yeah so cool

1893

01:13:40,790 --> 01:13:39,199

well tell us about your outfit i'm

1894

01:13:42,630 --> 01:13:40,800

dressed as you guys gave me an awesome

1895

01:13:44,470 --> 01:13:42,640

preamble too as artemis who is the

1896

01:13:46,470 --> 01:13:44,480

goddess of the moon and the twin sister

1897

01:13:48,470 --> 01:13:46,480

of apollo as well as the namesake for

1898

01:13:50,950 --> 01:13:48,480

nasa's next program that will take us to

1899

01:13:52,950 --> 01:13:50,960

the moon yep yep yep exactly the artemis

1900

01:13:55,189 --> 01:13:52,960

program sending the next man and the

1901

01:13:56,470 --> 01:13:55,199

first woman by 2020 yeah it's such an

1902

01:13:59,030 --> 01:13:56,480

exciting time to be getting involved

1903

01:14:01,270 --> 01:13:59,040

here yeah yeah good time for you too

1904

01:14:04,470 --> 01:14:01,280

yeah seriously

1905

01:14:06,630 --> 01:14:04,480

yeah just waltz right in and it happened

1906

01:14:07,910 --> 01:14:06,640

good timing good timing why don't you

1907

01:14:09,189 --> 01:14:07,920

talk about your research here what are

1908

01:14:10,790 --> 01:14:09,199

you working on yeah so right now i'm

1909

01:14:12,229 --> 01:14:10,800

studying meteorites we study um

1910

01:14:13,510 --> 01:14:12,239

extraterrestrial samples that have

1911

01:14:15,750 --> 01:14:13,520

fallen to earth

1912

01:14:17,350 --> 01:14:15,760

and we look for organic known compounds

1913

01:14:18,790 --> 01:14:17,360

that we can look at and kind of get a

1914

01:14:20,870 --> 01:14:18,800

sense for what was going on in the

1915

01:14:23,110 --> 01:14:20,880

universe about or our solar system at

1916

01:14:26,830 --> 01:14:23,120

least about 4.6 billion years ago wow

1917

01:14:29,030 --> 01:14:26,840

yeah is that when the earth was coming

1918

01:14:30,630 --> 01:14:29,040

together planetary creation

1919

01:14:32,550 --> 01:14:30,640

making the solar system happen and some

1920

01:14:34,310 --> 01:14:32,560

of those chunks kind of got like stuck

1921

01:14:36,070 --> 01:14:34,320

floating around in space and are in

1922

01:14:38,390 --> 01:14:36,080

orbit in our solar system and sometimes

1923

01:14:40,310 --> 01:14:38,400

one will land on earth for us to study

1924

01:14:41,990 --> 01:14:40,320

outstanding yeah

1925

01:14:43,990 --> 01:14:42,000

uh we i think we have a photo did you

1926

01:14:45,110 --> 01:14:44,000

bring a photo of him i did yeah i

1927

01:14:47,189 --> 01:14:45,120

brought a photo of myself with the

1928

01:14:48,870 --> 01:14:47,199

merchant meteorite oh wow yeah so that's

1929

01:14:50,310 --> 01:14:48,880

a sample that we have we don't get a lot

1930

01:14:52,630 --> 01:14:50,320

of the meteorite at any one time because

1931

01:14:54,870 --> 01:14:52,640

it's very precious and very rare oh yeah

1932

01:14:56,149 --> 01:14:54,880

this particular meteorite came crashing

1933

01:15:01,110 --> 01:14:56,159

through the roof of someone's barn in

1934

01:15:05,030 --> 01:15:02,390

but it was good because we were able to

1935

01:15:06,950 --> 01:15:05,040

get to it very quickly and preserve it

1936

01:15:09,510 --> 01:15:06,960

um so it's not very contaminated it's

1937

01:15:11,350 --> 01:15:09,520

really good for study wow and was that

1938

01:15:13,830 --> 01:15:11,360

dust from it was that it ground up in

1939

01:15:16,070 --> 01:15:13,840

there yeah yeah so um it was a bigger

1940

01:15:18,390 --> 01:15:16,080

meteorite uh it fragmented before it hit

1941

01:15:19,110 --> 01:15:18,400

earth and um that is a little fragment

1942

01:15:20,870 --> 01:15:19,120

of

1943

01:15:21,590 --> 01:15:20,880

the fragment that fell in there

1944

01:15:22,870 --> 01:15:21,600

yeah

1945

01:15:24,950 --> 01:15:22,880

so we have just little bits of it that

1946

01:15:27,030 --> 01:15:24,960

we're able to perform tests on with our

1947

01:15:29,189 --> 01:15:27,040

instruments and get a sense of what it's

1948

01:15:31,110 --> 01:15:29,199

made of okay yeah what's the big

1949

01:15:34,070 --> 01:15:31,120

question you're trying to answer with

1950

01:15:36,950 --> 01:15:34,080

your work so we're trying to answer the

1951

01:15:38,229 --> 01:15:36,960

origin of life um yeah it all begins

1952

01:15:39,669 --> 01:15:38,239

yeah when did it all begin so we're

1953

01:15:41,510 --> 01:15:39,679

looking for different compounds that

1954

01:15:44,310 --> 01:15:41,520

could have brought the building blocks

1955

01:15:46,470 --> 01:15:44,320

to earth to start of like kickstart life

1956

01:15:47,750 --> 01:15:46,480

okay right yeah yeah do you plan to

1957

01:15:49,110 --> 01:15:47,760

figure that out by the end of your

1958

01:15:50,630 --> 01:15:49,120

internship yeah

1959

01:15:54,070 --> 01:15:50,640

eight weeks so i think i can get it done

1960

01:15:58,310 --> 01:15:55,990

thank you thank you

1961

01:16:00,870 --> 01:15:58,320

amy in the chat looks

1962

01:16:03,430 --> 01:16:00,880

shocks and says very cool

1963

01:16:04,470 --> 01:16:03,440

thank you amy cool yeah yeah we have a

1964

01:16:07,110 --> 01:16:04,480

lot of fun

1965

01:16:09,030 --> 01:16:07,120

so you told us a funny story the other

1966

01:16:12,070 --> 01:16:09,040

day that you happen to know what

1967

01:16:14,470 --> 01:16:12,080

meteorites smell like yeah i i do that

1968

01:16:15,830 --> 01:16:14,480

again so my first day in my internship i

1969

01:16:17,669 --> 01:16:15,840

showed up and i was filled with nerves

1970

01:16:20,390 --> 01:16:17,679

and i was really excited and just like

1971

01:16:22,390 --> 01:16:20,400

just so pumped to be here and i meet my

1972

01:16:23,750 --> 01:16:22,400

mentor for the first time and he takes

1973

01:16:24,950 --> 01:16:23,760

out the sample and says you know this is

1974

01:16:27,189 --> 01:16:24,960

like the most precious thing that we

1975

01:16:28,630 --> 01:16:27,199

have in this lab like it's so expensive

1976

01:16:30,630 --> 01:16:28,640

we have so many tests to run on it and

1977

01:16:32,149 --> 01:16:30,640

so many questions about it he takes off

1978

01:16:34,229 --> 01:16:32,159

the cap and puts it under my nose and

1979

01:16:36,229 --> 01:16:34,239

says what does it smell like huh and i

1980

01:16:37,830 --> 01:16:36,239

was like is it okay is this the science

1981

01:16:40,070 --> 01:16:37,840

fair okay yeah let's do it and it

1982

01:16:42,709 --> 01:16:40,080

smelled like soil like

1983

01:16:43,990 --> 01:16:42,719

soil after it rains oh really yeah so

1984

01:16:45,669 --> 01:16:44,000

it's interesting i got to learn that

1985

01:16:51,350 --> 01:16:45,679

space smells like dirt

1986

01:16:55,830 --> 01:16:53,830

uh rj the noob has a question for you uh

1987

01:16:58,070 --> 01:16:55,840

what elements in the meteorites have you

1988

01:16:59,590 --> 01:16:58,080

found that are building blocks for life

1989

01:17:01,669 --> 01:16:59,600

um so previously people have been

1990

01:17:03,189 --> 01:17:01,679

looking at amino acids in the meteorites

1991

01:17:05,910 --> 01:17:03,199

and we're looking at a group of

1992

01:17:07,350 --> 01:17:05,920

compounds called carboxylic acids

1993

01:17:09,030 --> 01:17:07,360

um

1994

01:17:10,229 --> 01:17:09,040

so yeah if you don't think about organic

1995

01:17:11,990 --> 01:17:10,239

chemistry

1996

01:17:13,990 --> 01:17:12,000

are they related to amino acids they are

1997

01:17:15,669 --> 01:17:14,000

yes oh okay yeah okay so some kind of

1998

01:17:16,790 --> 01:17:15,679

like building block of the building

1999

01:17:19,510 --> 01:17:16,800

block of the building block doesn't look

2000

01:17:22,790 --> 01:17:19,520

good yeah exactly yeah that's awesome

2001

01:17:24,790 --> 01:17:22,800

yeah um and a related question yeah two

2002

01:17:26,550 --> 01:17:24,800

what kinds of tests do you do on the

2003

01:17:27,830 --> 01:17:26,560

meteors to see where they come from um

2004

01:17:30,149 --> 01:17:27,840

so right now we're doing ion

2005

01:17:32,229 --> 01:17:30,159

chromatography and gas chromatography

2006

01:17:33,830 --> 01:17:32,239

mass spectrometry so basically we take

2007

01:17:35,669 --> 01:17:33,840

the meteorites and we make them into a

2008

01:17:37,030 --> 01:17:35,679

little solution and get them all

2009

01:17:39,110 --> 01:17:37,040

prepared and inject them into these

2010

01:17:40,870 --> 01:17:39,120

machines that are able to tell us the

2011

01:17:42,709 --> 01:17:40,880

retention times of the different

2012

01:17:45,910 --> 01:17:42,719

compounds within the sample and then

2013

01:17:47,750 --> 01:17:45,920

we're able to run what we expect to find

2014

01:17:49,750 --> 01:17:47,760

it to compare that to to kind of get a

2015

01:17:52,149 --> 01:17:49,760

sense of like if it really is what we

2016

01:17:54,709 --> 01:17:52,159

think it is and how much is in there and

2017

01:17:56,709 --> 01:17:54,719

questions like that wow yeah that's very

2018

01:17:59,270 --> 01:17:56,719

cool thank you this is really great for

2019

01:18:00,470 --> 01:17:59,280

an internship yeah serious work very

2020

01:18:03,350 --> 01:18:00,480

pleased yeah

2021

01:18:04,870 --> 01:18:03,360

awesome yeah um do you have any tips for

2022

01:18:06,709 --> 01:18:04,880

anybody or could you tell us a little

2023

01:18:09,229 --> 01:18:06,719

bit about how you applied and got in

2024

01:18:11,350 --> 01:18:09,239

yeah so like lindley i went to

2025

01:18:13,510 --> 01:18:11,360

intern.nasa.gov where undergraduates

2026

01:18:15,030 --> 01:18:13,520

graduates and high schoolers i believe

2027

01:18:17,510 --> 01:18:15,040

too can um

2028

01:18:18,950 --> 01:18:17,520

can all apply for a nasa internship and

2029

01:18:20,550 --> 01:18:18,960

you just get to go on and kind of like

2030

01:18:23,350 --> 01:18:20,560

look for what projects interest you my

2031

01:18:26,149 --> 01:18:23,360

advice would be to not like pigeonhole

2032

01:18:27,510 --> 01:18:26,159

yourself into one special like focus uh

2033

01:18:29,510 --> 01:18:27,520

this is the first formal training i've

2034

01:18:30,709 --> 01:18:29,520

had in organic chemistry and i think the

2035

01:18:32,870 --> 01:18:30,719

only reason i'm here is just because i

2036

01:18:34,790 --> 01:18:32,880

put myself out there so i'd say

2037

01:18:35,990 --> 01:18:34,800

definitely like jump for things that you

2038

01:18:37,750 --> 01:18:36,000

want to do or you're interested in

2039

01:18:39,590 --> 01:18:37,760

because the scientists here they're

2040

01:18:41,030 --> 01:18:39,600

interested in educating the future of

2041

01:18:42,070 --> 01:18:41,040

science so

2042

01:18:43,990 --> 01:18:42,080

it's a great device

2043

01:18:45,669 --> 01:18:44,000

great awesome story an awesome

2044

01:18:47,590 --> 01:18:45,679

researcher thank you

2045

01:18:49,430 --> 01:18:47,600

very excited very cool

2046

01:18:51,910 --> 01:18:49,440

all right well before you go can you

2047

01:18:54,229 --> 01:18:51,920

give some tips on recreating your look

2048

01:18:56,070 --> 01:18:54,239

so my look starting with the crown i

2049

01:18:58,470 --> 01:18:56,080

made it out of a christmas decoration

2050

01:18:59,590 --> 01:18:58,480

that i sacrificed

2051  
01:19:00,950 --> 01:18:59,600  
sometimes you got to do that from

2052  
01:19:02,870 --> 01:19:00,960  
halloween

2053  
01:19:04,229 --> 01:19:02,880  
you can go to goodwill to find they have

2054  
01:19:05,430 --> 01:19:04,239  
a lot of things like this like capes

2055  
01:19:07,270 --> 01:19:05,440  
during the

2056  
01:19:09,590 --> 01:19:07,280  
halloween season

2057  
01:19:11,750 --> 01:19:09,600  
i made this out of a sheet it's like a

2058  
01:19:13,350 --> 01:19:11,760  
little tunic there yeah and i i don't

2059  
01:19:15,350 --> 01:19:13,360  
know if you could have seen but i

2060  
01:19:16,950 --> 01:19:15,360  
decided to give our modern artemis uh

2061  
01:19:22,709 --> 01:19:16,960  
hiking pants because i think she

2062  
01:19:26,709 --> 01:19:25,350  
yeah definitely and for the moon uh

2063  
01:19:28,550 --> 01:19:26,719

which you're the goddess of when you're

2064

01:19:30,470 --> 01:19:28,560

artemis that's right you can make this

2065

01:19:33,189 --> 01:19:30,480

out of tin foil paper mache and a

2066

01:19:35,270 --> 01:19:33,199

balloon you know paint yeah or 3d

2067

01:19:37,750 --> 01:19:35,280

printed if that's something you can do

2068

01:19:38,630 --> 01:19:37,760

all kinds of ways really yeah just get

2069

01:19:41,189 --> 01:19:38,640

creative

2070

01:19:42,870 --> 01:19:41,199

all right sweet thank you thank you so

2071

01:19:44,870 --> 01:19:42,880

much for having me all right we'll see

2072

01:19:46,310 --> 01:19:44,880

you in a little bit

2073

01:19:48,149 --> 01:19:46,320

all right

2074

01:19:50,070 --> 01:19:48,159

another cool one i'm always amazed by

2075

01:19:51,669 --> 01:19:50,080

our interns isn't it cool the meteorite

2076

01:19:52,709 --> 01:19:51,679

came just like landed in someone's barn

2077

01:19:56,470 --> 01:19:52,719

i know

2078

01:19:57,990 --> 01:19:56,480

you wake up the next morning like oh

2079

01:20:00,149 --> 01:19:58,000

i didn't expect that to be there i know

2080

01:20:02,550 --> 01:20:00,159

you're a farmer you've known no reason

2081

01:20:05,189 --> 01:20:02,560

to expect nasa to come knocking but

2082

01:20:07,669 --> 01:20:05,199

you've got a meteor in your barn

2083

01:20:10,629 --> 01:20:07,679

all right well let's move on you guys to

2084

01:20:12,950 --> 01:20:10,639

our last contenders

2085

01:20:15,510 --> 01:20:12,960

last but certainly not least this

2086

01:20:18,149 --> 01:20:15,520

remarkable duo just made history by

2087

01:20:21,030 --> 01:20:18,159

venturing outside together in the vacuum

2088

01:20:23,669 --> 01:20:21,040

of space come on out lauren and nicole

2089

01:20:24,770 --> 01:20:23,679

cosplaying as the first all-woman

2090

01:20:26,629 --> 01:20:24,780

spacewalk

2091

01:20:28,310 --> 01:20:26,639

[Music]

2092

01:20:30,830 --> 01:20:28,320

yeah

2093

01:20:32,470 --> 01:20:30,840

hello oh my gosh

2094

01:20:35,030 --> 01:20:32,480

what

2095

01:20:39,350 --> 01:20:37,510

i had no idea

2096

01:20:40,790 --> 01:20:39,360

you were gonna be following me cool you

2097

01:20:44,070 --> 01:20:40,800

guys

2098

01:20:46,550 --> 01:20:44,080

come right on up here my gosh

2099

01:20:48,070 --> 01:20:46,560

i'm so impressed yeah thank you i am too

2100

01:20:50,709 --> 01:20:48,080

i'm curious how we're going to recreate

2101

01:20:53,350 --> 01:20:50,719

that but we will come to that later

2102

01:20:55,189 --> 01:20:53,360

don't ruin it

2103

01:20:58,390 --> 01:20:55,199

okay so tell us your names and tell us

2104

01:21:01,830 --> 01:20:58,400

what you do here at ames yeah so my name

2105

01:21:03,990 --> 01:21:01,840

is nicole carter and this is i'm lauren

2106

01:21:07,030 --> 01:21:04,000

abbott i'm a material scientist and i am

2107

01:21:08,310 --> 01:21:07,040

a ceramic engineer material engineer

2108

01:21:09,910 --> 01:21:08,320

wow

2109

01:21:11,990 --> 01:21:09,920

we're both part of the material thermal

2110

01:21:13,669 --> 01:21:12,000

protection materials branch system

2111

01:21:15,669 --> 01:21:13,679

yeah so yeah as you mentioned so we're

2112

01:21:17,910 --> 01:21:15,679

here to celebrate the first all women

2113

01:21:20,310 --> 01:21:17,920

space walk yeah yeah yeah

2114

01:21:21,990 --> 01:21:20,320

yeah so astronauts christina cook and

2115

01:21:24,070 --> 01:21:22,000

jessica meer just completed this last

2116

01:21:26,310 --> 01:21:24,080

week uh the first time that we've had a

2117

01:21:27,750 --> 01:21:26,320

spacewalk completed by just women and

2118

01:21:29,270 --> 01:21:27,760

you know we were so pumped about it that

2119

01:21:30,470 --> 01:21:29,280

we wanted to dress up to celebrate

2120

01:21:33,030 --> 01:21:30,480

awesome so this is the perfect

2121

01:21:34,870 --> 01:21:33,040

opportunity for that it is yeah i mean

2122

01:21:37,030 --> 01:21:34,880

right around the corner it works out

2123

01:21:40,149 --> 01:21:37,040

well we have a photo of these two

2124

01:21:41,450 --> 01:21:40,159

astronauts yeah everybody oh yeah look

2125

01:21:43,830 --> 01:21:41,460

at that

2126

01:21:45,350 --> 01:21:43,840

[Laughter]

2127

01:21:47,189 --> 01:21:45,360

yeah i believe they live streamed the

2128

01:21:49,270 --> 01:21:47,199

spacewalk on twitch right so i don't

2129

01:21:50,470 --> 01:21:49,280

know it was pretty early that's awesome

2130

01:21:52,310 --> 01:21:50,480

it was really early in the morning but i

2131

01:21:53,669 --> 01:21:52,320

caught the end of it nice nice yeah i

2132

01:21:54,950 --> 01:21:53,679

think you can go back and see it if you

2133

01:21:57,110 --> 01:21:54,960

missed it

2134

01:21:58,149 --> 01:21:57,120

seven hours i think oh yeah yeah that's

2135

01:22:00,070 --> 01:21:58,159

right that's right yeah it's very

2136

01:22:02,870 --> 01:22:00,080

demanding a lot of it is isn't it

2137

01:22:04,870 --> 01:22:02,880

tedious work and in the vacuum exhaust

2138

01:22:07,350 --> 01:22:04,880

yeah yeah that's amazing

2139

01:22:09,510 --> 01:22:07,360

cool all right well tell us how that

2140

01:22:11,430 --> 01:22:09,520

relates to the work you do i don't think

2141

01:22:13,910 --> 01:22:11,440

you're asking unfortunately

2142

01:22:16,709 --> 01:22:13,920

as much as we would really maybe awesome

2143

01:22:18,229 --> 01:22:16,719

to be astronauts one day but uh no so we

2144

01:22:19,990 --> 01:22:18,239

actually work on materials that help

2145

01:22:21,510 --> 01:22:20,000

keep astronauts safe

2146

01:22:22,950 --> 01:22:21,520

so nicole mentioned we work on thermal

2147

01:22:25,270 --> 01:22:22,960

protection materials and those are

2148

01:22:27,110 --> 01:22:25,280

materials that go into heat shields that

2149

01:22:28,870 --> 01:22:27,120

uh protect the spacecraft when coming

2150

01:22:30,470 --> 01:22:28,880

back into atmosphere and earth so they

2151  
01:22:32,229 --> 01:22:30,480  
keep the astronauts safe when they

2152  
01:22:33,590 --> 01:22:32,239  
re-enter earth's atmosphere all right

2153  
01:22:35,910 --> 01:22:33,600  
yeah it gets up to pretty high

2154  
01:22:38,470 --> 01:22:35,920  
temperatures like you know yeah i think

2155  
01:22:40,790 --> 01:22:38,480  
we even have a model so here is that

2156  
01:22:42,470 --> 01:22:40,800  
here's the like the spacecraft coming

2157  
01:22:43,510 --> 01:22:42,480  
back into earth and the heat shield

2158  
01:22:44,870 --> 01:22:43,520  
would be

2159  
01:22:46,070 --> 01:22:44,880  
right on the front of that spacecraft

2160  
01:22:48,229 --> 01:22:46,080  
because they're going through different

2161  
01:22:49,350 --> 01:22:48,239  
atmospheres you get a lot of heat coming

2162  
01:22:53,110 --> 01:22:49,360  
through

2163  
01:22:55,910 --> 01:22:53,120

um pushing up against that uh spacecraft

2164

01:22:58,390 --> 01:22:55,920

right and so the temperature materials

2165

01:23:00,470 --> 01:22:58,400

that we use are able to

2166

01:23:01,990 --> 01:23:00,480

either push that heat away or just

2167

01:23:03,669 --> 01:23:02,000

insulate it just like kind of stuff and

2168

01:23:05,669 --> 01:23:03,679

that goes in your walls at home it's

2169

01:23:07,270 --> 01:23:05,679

just an insulation type of material oh

2170

01:23:09,510 --> 01:23:07,280

yeah to keep things cool to keep the

2171

01:23:11,510 --> 01:23:09,520

astronauts from yeah right now

2172

01:23:13,350 --> 01:23:11,520

keep the structure intact that kind of

2173

01:23:14,629 --> 01:23:13,360

stuff yeah same idea just really

2174

01:23:16,070 --> 01:23:14,639

high-tech

2175

01:23:16,950 --> 01:23:16,080

insulation

2176

01:23:19,270 --> 01:23:16,960

yes

2177

01:23:21,510 --> 01:23:19,280

yeah it's not a typical uh

2178

01:23:23,270 --> 01:23:21,520

type of environment that we happen to

2179

01:23:25,750 --> 01:23:23,280

see on earth very often it's kind of a

2180

01:23:27,350 --> 01:23:25,760

space specialty right yeah we actually

2181

01:23:29,110 --> 01:23:27,360

have a couple

2182

01:23:32,470 --> 01:23:29,120

samples of the materials that are get

2183

01:23:35,270 --> 01:23:32,480

used wow awesome cool

2184

01:23:37,990 --> 01:23:35,280

we have some gloves if you wanted to uh

2185

01:23:39,430 --> 01:23:38,000

hold on to them but

2186

01:23:41,350 --> 01:23:39,440

you may want to take a glove just

2187

01:24:01,030 --> 01:23:41,360

because they have a little bit of

2188

01:24:06,149 --> 01:24:03,669

a carbon ablator and a blader is

2189

01:24:07,669 --> 01:24:06,159

something that when it heats up it

2190

01:24:09,830 --> 01:24:07,679

creates a chemical reaction that

2191

01:24:12,229 --> 01:24:09,840

actually throws off heat

2192

01:24:14,070 --> 01:24:12,239

away from the spacecraft so you can see

2193

01:24:15,270 --> 01:24:14,080

it's really light right so obviously

2194

01:24:17,030 --> 01:24:15,280

when we're sending stuff to space we

2195

01:24:19,750 --> 01:24:17,040

want to keep it nice and light because

2196

01:24:21,270 --> 01:24:19,760

every every pound matters yeah so if we

2197

01:24:23,350 --> 01:24:21,280

can keep the heat shield light it gives

2198

01:24:25,270 --> 01:24:23,360

us more more space to put other things

2199

01:24:27,270 --> 01:24:25,280

and more weight that we can

2200

01:24:28,950 --> 01:24:27,280

you know do in science experiments and

2201

01:24:31,430 --> 01:24:28,960

that kind of stuff yeah so that yellow

2202

01:24:33,189 --> 01:24:31,440

is the phenolic resin that we use and

2203

01:24:34,790 --> 01:24:33,199

then the car the block that you see in

2204

01:24:36,790 --> 01:24:34,800

there is that carbon

2205

01:24:38,629 --> 01:24:36,800

yeah so so one thing we do as a material

2206

01:24:40,149 --> 01:24:38,639

scientist is we try to understand the

2207

01:24:42,709 --> 01:24:40,159

microstructure of the material so we

2208

01:24:45,430 --> 01:24:42,719

have here this is a 3d printed

2209

01:24:47,030 --> 01:24:45,440

microstructure of the carbon fibers that

2210

01:24:48,709 --> 01:24:47,040

are in pika and obviously this isn't a

2211

01:24:50,390 --> 01:24:48,719

scale right right

2212

01:24:51,590 --> 01:24:50,400

made it big so you can actually see it i

2213

01:24:53,510 --> 01:24:51,600

don't know if we can get a close-up of

2214

01:24:56,229 --> 01:24:53,520

you can take a look at that if you hold

2215

01:24:57,590 --> 01:24:56,239

it here actually

2216

01:25:00,629 --> 01:24:57,600

so we can get closer of that you can see

2217

01:25:02,070 --> 01:25:00,639

all the carbon fibers that are uh making

2218

01:25:03,910 --> 01:25:02,080

up the substrate of that and so these

2219

01:25:05,510 --> 01:25:03,920

carbon fibers are on the scale of

2220

01:25:07,270 --> 01:25:05,520

microns so it's kind of like the

2221

01:25:09,110 --> 01:25:07,280

thickness of your hair oh wow so that

2222

01:25:10,790 --> 01:25:09,120

would be a good comparison so these are

2223

01:25:12,629 --> 01:25:10,800

obviously much bigger but this is what

2224

01:25:14,629 --> 01:25:12,639

the carbon fiber substrate looks like in

2225

01:25:17,270 --> 01:25:14,639

pika and we infuse that with the

2226

01:25:18,950 --> 01:25:17,280

phenolic resin how cool wow

2227

01:25:20,310 --> 01:25:18,960

why are we wearing gloves

2228

01:25:22,629 --> 01:25:20,320

yeah so it's like to protect it or

2229

01:25:24,229 --> 01:25:22,639

protect it you can see a little bit

2230

01:25:26,070 --> 01:25:24,239

yeah a little bit of stuff comes off of

2231

01:25:28,070 --> 01:25:26,080

it right i got some dust and you might

2232

01:25:29,590 --> 01:25:28,080

see a little bit of yellow on it so it's

2233

01:25:31,270 --> 01:25:29,600

you just don't want it to getting into

2234

01:25:33,350 --> 01:25:31,280

your skin it's got little carbon pieces

2235

01:25:34,790 --> 01:25:33,360

in it okay just to keep you safe nice

2236

01:25:37,430 --> 01:25:34,800

and protection so you would use this

2237

01:25:40,709 --> 01:25:37,440

material for a heat shield yeah so this

2238

01:25:42,070 --> 01:25:40,719

one yeah this one is good for uh so

2239

01:25:44,709 --> 01:25:42,080

because it's ablative as nicole

2240

01:25:46,470 --> 01:25:44,719

mentioned it it decomposes on re-entry

2241

01:25:48,629 --> 01:25:46,480

so it takes away the heat from the

2242

01:25:50,229 --> 01:25:48,639

spacecraft and it's not reusable so it's

2243

01:25:52,229 --> 01:25:50,239

something we would only use one time

2244

01:25:55,590 --> 01:25:52,239

yeah and then it would be thrown away

2245

01:25:58,870 --> 01:25:55,600

but we do have re uh reusable gps let me

2246

01:26:01,110 --> 01:25:58,880

put this one away reusable tps reusable

2247

01:26:02,629 --> 01:26:01,120

yeah so that's the more common

2248

01:26:04,470 --> 01:26:02,639

shuttle tile that a lot of people tend

2249

01:26:07,189 --> 01:26:04,480

to know is back in the shuttle days and

2250

01:26:08,950 --> 01:26:07,199

that's the whole the white uh silica

2251

01:26:13,030 --> 01:26:08,960

blocks that you'll see

2252

01:26:14,950 --> 01:26:13,040

um and they can typically be recycled

2253

01:26:17,910 --> 01:26:14,960

multiple times the only time that it

2254

01:26:19,830 --> 01:26:17,920

really gets has to be

2255

01:26:21,830 --> 01:26:19,840

replaced is when there's any damage from

2256

01:26:23,270 --> 01:26:21,840

asteroids and meteors or any just uh

2257

01:26:25,430 --> 01:26:23,280

particles that are in space that are

2258

01:26:28,470 --> 01:26:25,440

hard so what kind of material is this so

2259

01:26:30,470 --> 01:26:28,480

this is silica alumina

2260

01:26:31,910 --> 01:26:30,480

and borosilicate glass

2261

01:26:33,910 --> 01:26:31,920

and glass has such a high melting

2262

01:26:36,470 --> 01:26:33,920

temperature so it doesn't

2263

01:26:38,070 --> 01:26:36,480

deform when in the higher re-entry

2264

01:26:40,070 --> 01:26:38,080

atmosphere temperatures

2265

01:26:42,629 --> 01:26:40,080

and it's actually super lightweight

2266

01:26:44,550 --> 01:26:42,639

because air is actually a

2267

01:26:45,430 --> 01:26:44,560

poor conductor of heat

2268

01:26:48,629 --> 01:26:45,440

so

2269

01:26:50,310 --> 01:26:48,639

with a lot of air in the material the

2270

01:26:52,629 --> 01:26:50,320

heat transfer doesn't want to go through

2271

01:26:54,550 --> 01:26:52,639

it as fast as like metal metal conducts

2272

01:26:56,550 --> 01:26:54,560

heat very quickly yeah

2273

01:26:58,470 --> 01:26:56,560

right you can get the metal to heat very

2274

01:27:00,390 --> 01:26:58,480

quickly exactly yeah so unlike the

2275

01:27:01,830 --> 01:27:00,400

polymers which like i said decompose at

2276

01:27:03,669 --> 01:27:01,840

high temperatures and we start you can

2277

01:27:05,590 --> 01:27:03,679

actually see the layer start to recede

2278

01:27:07,590 --> 01:27:05,600

over time these

2279

01:27:09,110 --> 01:27:07,600

won't do that so you'll be able to use

2280

01:27:10,390 --> 01:27:09,120

them like putting them on like we used

2281

01:27:12,550 --> 01:27:10,400

to have them on the spatial and we can

2282

01:27:14,550 --> 01:27:12,560

use that re that spatial we can reuse it

2283

01:27:16,550 --> 01:27:14,560

several times before we need to replace

2284

01:27:18,310 --> 01:27:16,560

them and so that helps with costs and

2285

01:27:19,110 --> 01:27:18,320

and it has some performance benefits as

2286

01:27:20,950 --> 01:27:19,120

well

2287

01:27:22,870 --> 01:27:20,960

so how do you guys do this research with

2288

01:27:23,910 --> 01:27:22,880

the materials and find out more about

2289

01:27:26,870 --> 01:27:23,920

them

2290

01:27:29,030 --> 01:27:26,880

uh so my side of it i do a lot of the

2291

01:27:29,830 --> 01:27:29,040

physical testing of the material so we

2292

01:27:31,669 --> 01:27:29,840

can

2293

01:27:34,470 --> 01:27:31,679

um we have what's called the arc jet

2294

01:27:37,270 --> 01:27:34,480

which is a plasma gun that shoots up to

2295

01:27:39,750 --> 01:27:37,280

3000 f

2296

01:27:43,110 --> 01:27:39,760

if not more if not more yeah you should

2297

01:27:44,830 --> 01:27:43,120

know that right very high temperatures

2298

01:27:47,030 --> 01:27:44,840

yes

2299

01:27:48,950 --> 01:27:47,040

um simulation

2300

01:27:51,189 --> 01:27:48,960

heat right yeah so we can stick these

2301

01:27:53,030 --> 01:27:51,199

materials in that plasma gun it shoots

2302

01:27:55,350 --> 01:27:53,040

it we'll take a look at it afterwards

2303

01:27:56,709 --> 01:27:55,360

see what it how it deforms from

2304

01:27:58,790 --> 01:27:56,719

different temperatures we can even

2305

01:28:00,629 --> 01:27:58,800

increase the pressure there

2306

01:28:03,270 --> 01:28:00,639

and do different or even lower pressures

2307

01:28:05,030 --> 01:28:03,280

to kind of re-simulate the low

2308

01:28:06,629 --> 01:28:05,040

atmospheric pressure in space yeah

2309

01:28:09,189 --> 01:28:06,639

unfortunately we can't just send stuff

2310

01:28:10,550 --> 01:28:09,199

to space and bring it back

2311

01:28:12,070 --> 01:28:10,560

that's the best that we can do to try to

2312

01:28:13,910 --> 01:28:12,080

replicate that environment on earth

2313

01:28:15,990 --> 01:28:13,920

right another thing we do so what i work

2314

01:28:18,229 --> 01:28:16,000

on i do computational modeling of these

2315

01:28:19,990 --> 01:28:18,239

materials at different length skills and

2316

01:28:21,590 --> 01:28:20,000

the benefit of using computational tools

2317

01:28:23,430 --> 01:28:21,600

is we can do that a little more cheaply

2318

01:28:25,990 --> 01:28:23,440

on the computer than we could a test and

2319

01:28:27,910 --> 01:28:26,000

an arc test can be very expensive so we

2320

01:28:29,830 --> 01:28:27,920

can do some screening of materials ahead

2321

01:28:31,830 --> 01:28:29,840

of time in computer simulations and

2322

01:28:33,430 --> 01:28:31,840

understand how that material behaves in

2323

01:28:35,189 --> 01:28:33,440

these environments as well

2324

01:28:36,709 --> 01:28:35,199

and that's much safer and cheaper than

2325

01:28:39,350 --> 01:28:36,719

the experiments would be

2326  
01:28:41,350 --> 01:28:39,360  
um you might start there and then yeah

2327  
01:28:43,350 --> 01:28:41,360  
exactly and we work very closely

2328  
01:28:45,030 --> 01:28:43,360  
together so we'll simulate things and

2329  
01:28:46,950 --> 01:28:45,040  
they'll test them and we'll compare and

2330  
01:28:48,709 --> 01:28:46,960  
and it'll help iterate the process of

2331  
01:28:50,470 --> 01:28:48,719  
testing and designing new materials and

2332  
01:28:52,709 --> 01:28:50,480  
testing old materials and understanding

2333  
01:28:53,990 --> 01:28:52,719  
what environments they'll work in

2334  
01:28:56,709 --> 01:28:54,000  
because you would use a different kind

2335  
01:28:57,590 --> 01:28:56,719  
of material for a different kind of

2336  
01:28:58,470 --> 01:28:57,600  
that's right

2337  
01:29:00,470 --> 01:28:58,480  
these are

2338  
01:29:02,070 --> 01:29:00,480

the same kind of heat shields

2339

01:29:03,669 --> 01:29:02,080

exactly yeah they they all have a

2340

01:29:05,030 --> 01:29:03,679

special purpose so depending on what the

2341

01:29:06,950 --> 01:29:05,040

mission is we'll pick the right heat

2342

01:29:08,629 --> 01:29:06,960

shield is because we want to minimize

2343

01:29:10,229 --> 01:29:08,639

mass so we'll pick the right heat shield

2344

01:29:11,910 --> 01:29:10,239

that'll get the job done but not

2345

01:29:13,669 --> 01:29:11,920

something that's too much that way we

2346

01:29:16,149 --> 01:29:13,679

can keep the mass low and then even like

2347

01:29:16,950 --> 01:29:16,159

under tiles there are like

2348

01:29:19,270 --> 01:29:16,960

a

2349

01:29:21,430 --> 01:29:19,280

bunch of different types of shuttle

2350

01:29:23,510 --> 01:29:21,440

tiles that could be more useful on

2351

01:29:25,750 --> 01:29:23,520

certain parts of the ship

2352

01:29:27,350 --> 01:29:25,760

versus some other part of tiles so that

2353

01:29:28,550 --> 01:29:27,360

i even in there i have two different

2354

01:29:30,470 --> 01:29:28,560

tiles that

2355

01:29:32,149 --> 01:29:30,480

one was processed slightly differently

2356

01:29:34,149 --> 01:29:32,159

and they have different properties for

2357

01:29:36,310 --> 01:29:34,159

it so being able to test it and know

2358

01:29:38,070 --> 01:29:36,320

where exactly should go on the ship or

2359

01:29:40,550 --> 01:29:38,080

what type of mission it should go into

2360

01:29:42,149 --> 01:29:40,560

is is really key can i ask you some

2361

01:29:45,990 --> 01:29:42,159

questions quickly from the chat while

2362

01:29:48,870 --> 01:29:46,000

yeah i'm backing there uh la la 147 says

2363

01:29:51,750 --> 01:29:48,880

that's awesome i love your work um how

2364

01:29:53,910 --> 01:29:51,760

third asks are there any ceramics inside

2365

01:29:56,709 --> 01:29:53,920

the spacecraft

2366

01:29:58,310 --> 01:29:56,719

not that i deal with okay do the outside

2367

01:30:00,790 --> 01:29:58,320

of the spacecraft we have all sorts of

2368

01:30:02,149 --> 01:30:00,800

materials in space and you know ceramics

2369

01:30:03,830 --> 01:30:02,159

are really great in high temperatures so

2370

01:30:05,590 --> 01:30:03,840

we see those a lot in environments we're

2371

01:30:06,950 --> 01:30:05,600

expecting to get up to high temperatures

2372

01:30:08,550 --> 01:30:06,960

because they won't melt at these high

2373

01:30:10,310 --> 01:30:08,560

temperatures and ceramics are also

2374

01:30:12,550 --> 01:30:10,320

they're everywhere so a lot of people

2375

01:30:14,070 --> 01:30:12,560

don't know what ceramics kind of entail

2376

01:30:15,990 --> 01:30:14,080

but like they're in your car engine

2377

01:30:17,910 --> 01:30:16,000

actually so you have like the metal

2378

01:30:19,590 --> 01:30:17,920

engine but like the oxygen two sensor

2379

01:30:22,950 --> 01:30:19,600

that is a ceramic material that gets

2380

01:30:24,550 --> 01:30:22,960

used um glass gets used it's a ceramic

2381

01:30:26,310 --> 01:30:24,560

um yeah so there could be plenty of

2382

01:30:28,149 --> 01:30:26,320

everything a lot of electronics

2383

01:30:30,149 --> 01:30:28,159

semiconductors so there's definitely

2384

01:30:31,189 --> 01:30:30,159

storms inside the shuttle i just don't

2385

01:30:32,629 --> 01:30:31,199

do that

2386

01:30:33,990 --> 01:30:32,639

yeah so one other thing we do so

2387

01:30:35,750 --> 01:30:34,000

sometimes in high temperatures you just

2388

01:30:37,350 --> 01:30:35,760

need to coat a material you just add a

2389

01:30:38,470 --> 01:30:37,360

coating on top of some kind of material

2390

01:30:40,310 --> 01:30:38,480

that can withstand the high temperatures

2391

01:30:42,390 --> 01:30:40,320

to protect the material underneath so

2392

01:30:44,390 --> 01:30:42,400

this is an example of a of a material

2393

01:30:46,709 --> 01:30:44,400

that has a coating on top that has some

2394

01:30:48,790 --> 01:30:46,719

kind of protective properties to it oh

2395

01:30:50,709 --> 01:30:48,800

yeah and so it also kind of helps um

2396

01:30:52,470 --> 01:30:50,719

create a tougher so these guys they're

2397

01:30:53,750 --> 01:30:52,480

very lightweight they're low density

2398

01:30:57,430 --> 01:30:53,760

they're kind of

2399

01:30:59,430 --> 01:30:57,440

um susceptible to compression um and so

2400

01:31:02,149 --> 01:30:59,440

that glass coating on top of it can also

2401  
01:31:04,629 --> 01:31:02,159  
help kind of dissipate any sort of uh

2402  
01:31:06,229 --> 01:31:04,639  
energy coming across

2403  
01:31:07,910 --> 01:31:06,239  
compressive right yeah so i think we

2404  
01:31:09,430 --> 01:31:07,920  
have a great movie to show this so so i

2405  
01:31:11,030 --> 01:31:09,440  
said that we do simulations one of the

2406  
01:31:12,550 --> 01:31:11,040  
simulations that we do is all the way

2407  
01:31:15,110 --> 01:31:12,560  
down to the atomistic scale so looking

2408  
01:31:17,430 --> 01:31:15,120  
at atoms individually in these materials

2409  
01:31:19,590 --> 01:31:17,440  
okay at the nano scale and if you roll

2410  
01:31:20,709 --> 01:31:19,600  
the video like a video of explain what's

2411  
01:31:22,950 --> 01:31:20,719  
going on

2412  
01:31:25,510 --> 01:31:22,960  
simulation so this is it will be you'll

2413  
01:31:27,270 --> 01:31:25,520

see a microstructure uh once it comes up

2414

01:31:29,030 --> 01:31:27,280

a microstructure of a material and so

2415

01:31:30,709 --> 01:31:29,040

the microstructure is made up of what

2416

01:31:32,229 --> 01:31:30,719

are called grains and these are crystal

2417

01:31:33,189 --> 01:31:32,239

lights that are oriented in different

2418

01:31:34,390 --> 01:31:33,199

ways

2419

01:31:36,790 --> 01:31:34,400

i think we're at the end of the movie

2420

01:31:38,229 --> 01:31:36,800

can we maybe let's start yeah

2421

01:31:40,310 --> 01:31:38,239

so these are all the different grains so

2422

01:31:42,470 --> 01:31:40,320

the blue regions are are very well

2423

01:31:44,390 --> 01:31:42,480

ordered crystals and then the gray is

2424

01:31:46,229 --> 01:31:44,400

the boundaries between these grains and

2425

01:31:48,629 --> 01:31:46,239

in the simulations these are now 16

2426  
01:31:50,629 --> 01:31:48,639  
million atoms it's about 60 nanometers

2427  
01:31:51,830 --> 01:31:50,639  
in scale so you can see as we pull this

2428  
01:31:53,669 --> 01:31:51,840  
material apart we can start to

2429  
01:31:55,669 --> 01:31:53,679  
understand how that material fails at

2430  
01:31:57,990 --> 01:31:55,679  
the atomistic scale so you can see that

2431  
01:31:59,430 --> 01:31:58,000  
it starts to crack between these on

2432  
01:32:01,110 --> 01:31:59,440  
these grain boundaries between the

2433  
01:32:02,550 --> 01:32:01,120  
grains and so now we can start to

2434  
01:32:04,950 --> 01:32:02,560  
understand the failure mechanisms of

2435  
01:32:07,110 --> 01:32:04,960  
these materials yeah and by doing that

2436  
01:32:09,030 --> 01:32:07,120  
we can hopefully improve them and and

2437  
01:32:10,870 --> 01:32:09,040  
find out when we can use them and when

2438  
01:32:12,790 --> 01:32:10,880

we can't and how we can make materials

2439

01:32:16,390 --> 01:32:12,800

that do better okay so cool that's

2440

01:32:21,110 --> 01:32:18,950

multiple times already so neat yeah

2441

01:32:23,110 --> 01:32:21,120

simulations are awesome so yeah

2442

01:32:24,709 --> 01:32:23,120

yeah absolutely and we do a lot of them

2443

01:32:26,310 --> 01:32:24,719

here at nasa don't you nasa likes to use

2444

01:32:27,590 --> 01:32:26,320

a lot of models like like i mentioned

2445

01:32:29,030 --> 01:32:27,600

already right it's really expensive to

2446

01:32:30,790 --> 01:32:29,040

do some of the tests that we do and it's

2447

01:32:32,070 --> 01:32:30,800

not easy to just test things in space

2448

01:32:33,830 --> 01:32:32,080

right so the more we can do things like

2449

01:32:35,430 --> 01:32:33,840

computers the better and computers are

2450

01:32:37,510 --> 01:32:35,440

getting so fast we actually have a super

2451

01:32:39,350 --> 01:32:37,520

computer here at ames

2452

01:32:41,830 --> 01:32:39,360

so that lets us run very large

2453

01:32:42,950 --> 01:32:41,840

simulations like 16 million atoms right

2454

01:32:50,070 --> 01:32:42,960

yeah

2455

01:32:51,430 --> 01:32:50,080

you go and

2456

01:32:53,350 --> 01:32:51,440

before you go

2457

01:32:56,149 --> 01:32:53,360

do you have any advice for us on how we

2458

01:32:58,070 --> 01:32:56,159

can recreate your costumes

2459

01:33:00,629 --> 01:32:58,080

well for me i'm wearing some pretty

2460

01:33:02,070 --> 01:33:00,639

cushy pants i feel like i'm in a cloud

2461

01:33:03,110 --> 01:33:02,080

or a pillow

2462

01:33:05,669 --> 01:33:03,120

and

2463

01:33:07,270 --> 01:33:05,679

you can use like this boxy thing to help

2464

01:33:09,189 --> 01:33:07,280

get your little switches which don't

2465

01:33:10,950 --> 01:33:09,199

work on mine but that's okay they have

2466

01:33:12,149 --> 01:33:10,960

to work i mean they've yeah yeah they

2467

01:33:13,590 --> 01:33:12,159

give them a little

2468

01:33:15,270 --> 01:33:13,600

if you're really engineering you can

2469

01:33:17,910 --> 01:33:15,280

like hook these things up to some light

2470

01:33:19,510 --> 01:33:17,920

bulbs yeah

2471

01:33:24,790 --> 01:33:19,520

i feel like you can get a backpack and

2472

01:33:29,110 --> 01:33:26,629

like a bicycle helmet yeah like a

2473

01:33:31,030 --> 01:33:29,120

motorcycle helmet fish tank

2474

01:33:32,470 --> 01:33:31,040

yeah those things absolutely creative

2475

01:33:33,990 --> 01:33:32,480

about it yeah yeah

2476

01:33:35,350 --> 01:33:34,000

your lovely outfit i mean mine's a

2477

01:33:36,950 --> 01:33:35,360

little easier we've already seen a few

2478

01:33:38,709 --> 01:33:36,960

of these types of outfits like a nice

2479

01:33:40,229 --> 01:33:38,719

coverall suit something you can pick up

2480

01:33:42,870 --> 01:33:40,239

at a local hardware store or something

2481

01:33:44,390 --> 01:33:42,880

like that yeah maybe paint yeah print

2482

01:33:46,229 --> 01:33:44,400

out some nasa

2483

01:33:47,910 --> 01:33:46,239

uh logos maybe you know get the red

2484

01:33:49,430 --> 01:33:47,920

white and blue in there and slap them on

2485

01:33:52,709 --> 01:33:49,440

put your name on it all that kind of

2486

01:33:55,110 --> 01:33:52,719

stuff yeah represent nasa yeah awesome

2487

01:33:56,709 --> 01:33:55,120

we can manage that excellent tips thank

2488

01:33:59,510 --> 01:33:56,719

you thanks for hanging out with all of

2489

01:34:01,510 --> 01:33:59,520

these yeah examples to show us yeah i've

2490

01:34:08,550 --> 01:34:01,520

heard about heat shields you guys said

2491

01:34:14,149 --> 01:34:11,750

yeah we'll see you in just a moment

2492

01:34:16,310 --> 01:34:14,159

because it's already time to vote on our

2493

01:34:17,830 --> 01:34:16,320

second segment yes do you know who you'd

2494

01:34:19,830 --> 01:34:17,840

vote for have you voted tiffany you get

2495

01:34:22,149 --> 01:34:19,840

to vote too so i know who i want to vote

2496

01:34:24,470 --> 01:34:22,159

for but i'm going to keep it a secret

2497

01:34:26,709 --> 01:34:24,480

you don't you don't want to buy it in

2498

01:34:28,950 --> 01:34:26,719

anybody out there no influences in the

2499

01:34:30,390 --> 01:34:28,960

chat you know so and did you get some

2500

01:34:31,750 --> 01:34:30,400

more ideas

2501

01:34:33,510 --> 01:34:31,760

they did definitely so this has been

2502

01:34:36,629 --> 01:34:33,520

really good because i i was not prepared

2503

01:34:38,950 --> 01:34:36,639

for halloween no i never am so

2504

01:34:40,550 --> 01:34:38,960

i look forward to this show yeah giving

2505

01:34:44,629 --> 01:34:40,560

me ideas

2506

01:34:46,950 --> 01:34:44,639

all right are you guys all ready to vote

2507

01:34:49,270 --> 01:34:46,960

all right time to vote for your favorite

2508

01:34:51,430 --> 01:34:49,280

cosplay costume we're going to bring all

2509

01:34:52,950 --> 01:34:51,440

of our guests back out and you can vote

2510

01:34:56,790 --> 01:34:52,960

in the chat for your favorite look all

2511

01:35:00,550 --> 01:34:56,800

right so first up will it be

2512

01:35:04,709 --> 01:35:00,560

kimberly as the astrophysicist

2513

01:35:10,310 --> 01:35:07,350

she does it so well she was born to be

2514

01:35:15,350 --> 01:35:11,830

love it

2515

01:35:18,070 --> 01:35:15,360

yes or will it be sumeda and emily as

2516

01:35:19,270 --> 01:35:18,080

nasa's starfleet command

2517

01:35:22,229 --> 01:35:19,280

hello

2518

01:35:26,629 --> 01:35:22,239

live long and prosper indeed yeah

2519

01:35:29,430 --> 01:35:26,639

looking good next is daisy as artemis

2520

01:35:31,350 --> 01:35:29,440

hello

2521

01:35:34,330 --> 01:35:31,360

and here is one more look at lauren and

2522

01:35:38,070 --> 01:35:34,340

nicole as the first all-woman spacewalk

2523

01:35:39,669 --> 01:35:38,080

[Music]

2524

01:35:41,350 --> 01:35:39,679

yeah

2525

01:35:46,470 --> 01:35:41,360

oh they're all so good

2526

01:35:48,950 --> 01:35:46,480

i don't know so get your tickets in yeah

2527

01:35:50,709 --> 01:35:48,960

now is the time to vote

2528

01:35:52,550 --> 01:35:50,719

we are tallying

2529

01:35:54,310 --> 01:35:52,560

your hearts in the chat get your last

2530

01:35:55,990 --> 01:35:54,320

poses in

2531

01:35:57,669 --> 01:35:56,000

right because your votes are coming a

2532

01:36:05,590 --> 01:35:57,679

chance

2533

01:36:07,590 --> 01:36:05,600

enjoy your moon show us your model

2534

01:36:08,629 --> 01:36:07,600

all right

2535

01:36:10,550 --> 01:36:08,639

ready

2536

01:36:13,990 --> 01:36:10,560

it's a clue it's a close one that's why

2537

01:36:16,629 --> 01:36:14,000

this is tough all right the i've got the

2538

01:36:18,310 --> 01:36:16,639

answer our winner is

2539

01:36:21,669 --> 01:36:18,320

darth kimberly

2540

01:36:26,310 --> 01:36:24,510

yes

2541

01:36:29,270 --> 01:36:26,320

[Music]

2542

01:36:31,189 --> 01:36:29,280

that's so clever i'm stealing that idea

2543

01:36:34,229 --> 01:36:31,199

yes that's for sure yeah

2544

01:36:35,590 --> 01:36:34,239

but you all look fabulous yeah thank you

2545

01:36:37,590 --> 01:36:35,600

for sharing your research with us and

2546

01:36:39,189 --> 01:36:37,600

your costume ideas this has been awesome

2547

01:36:42,709 --> 01:36:39,199

yeah

2548

01:36:48,310 --> 01:36:44,790

so we'll see you guys soon